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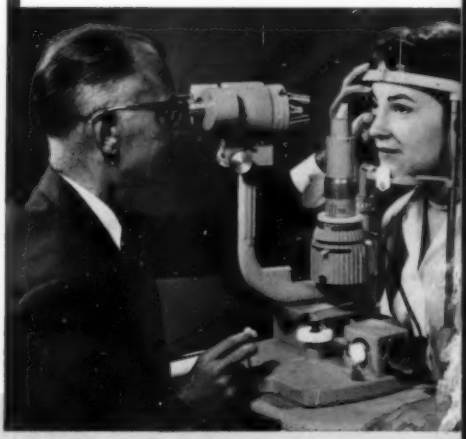

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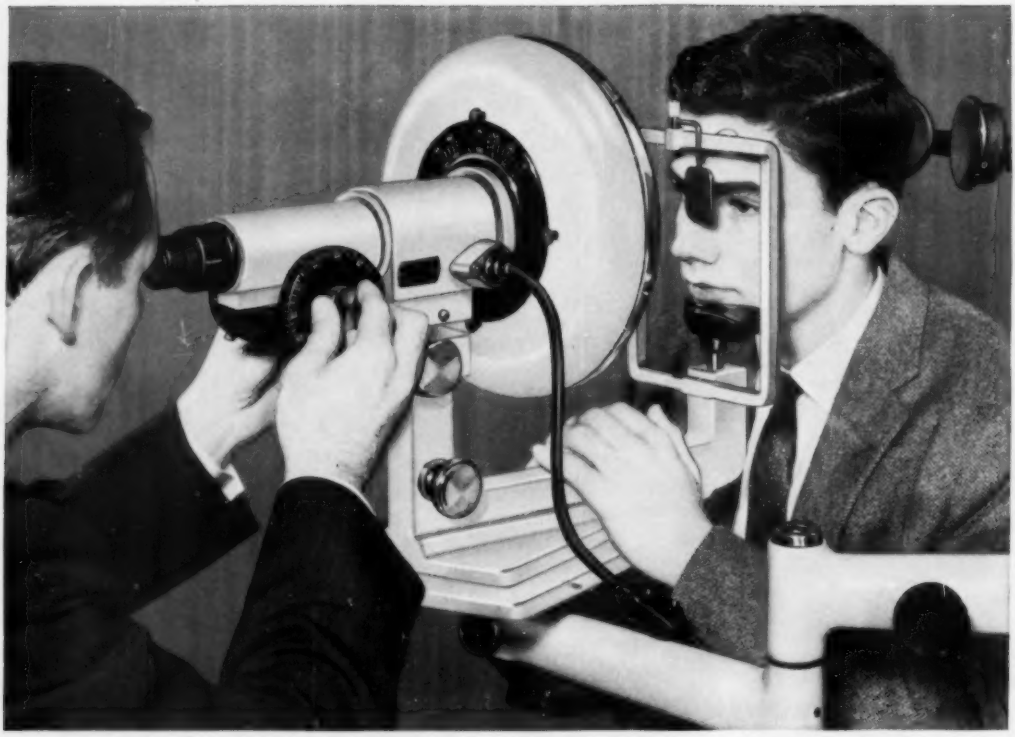

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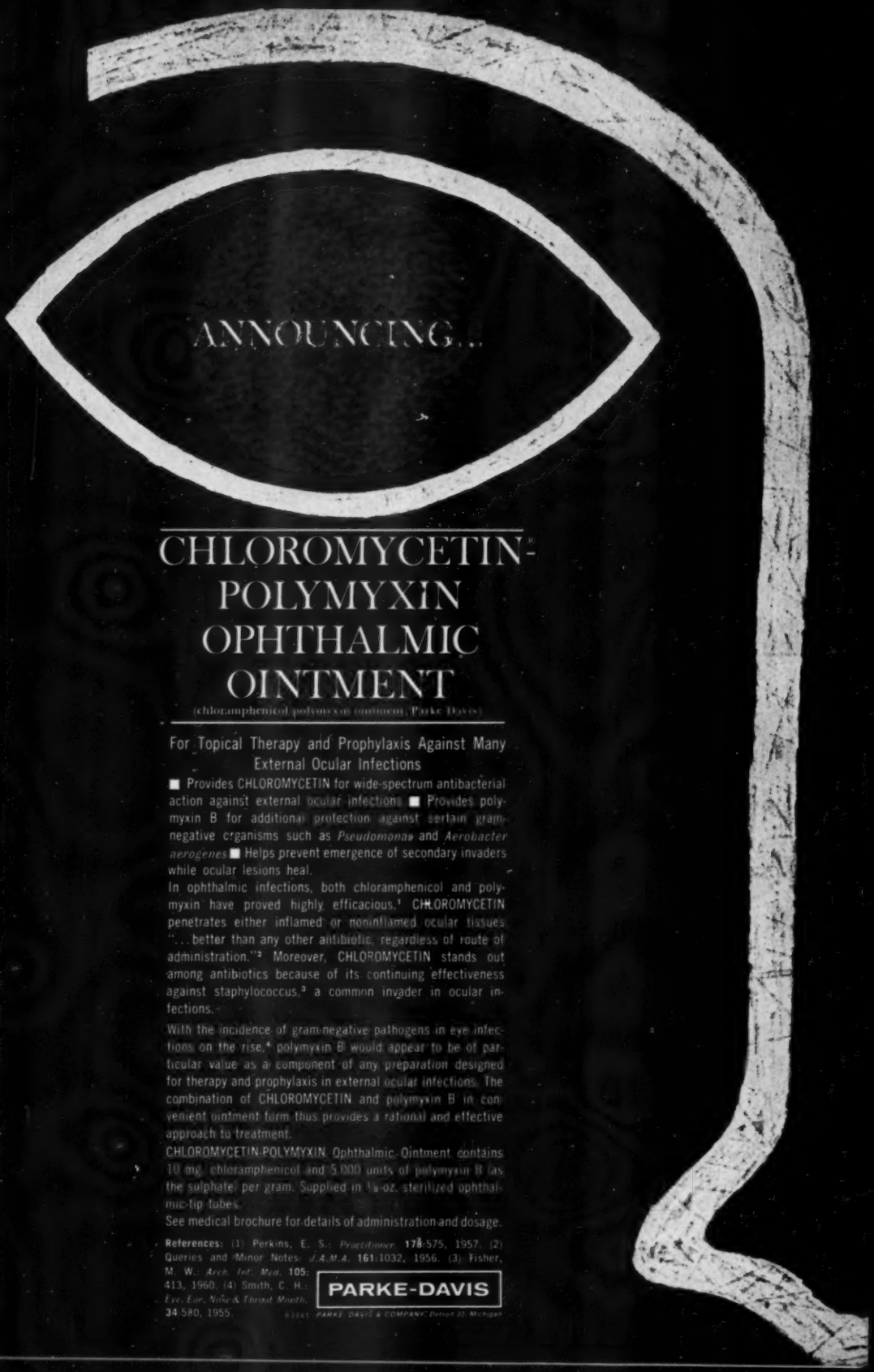

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1. Cogan, J. E. H.: Proc. Roy. Soc. Med. *51*:927, 1958. 2. Jenkins, B. H.: South. M. J. *53*:44, 1960; discussion by Raiford, M. B. 3. Raiford, M. B.: J.M.A. Georgia *48*:163, 1959. 4. Rizzuti, A. B.: A.M.A. Arch. Ophth. *61*:135, 1959. 5. Thorpe, H. E.: Am. J. Ophth. *49*:531, 1960.

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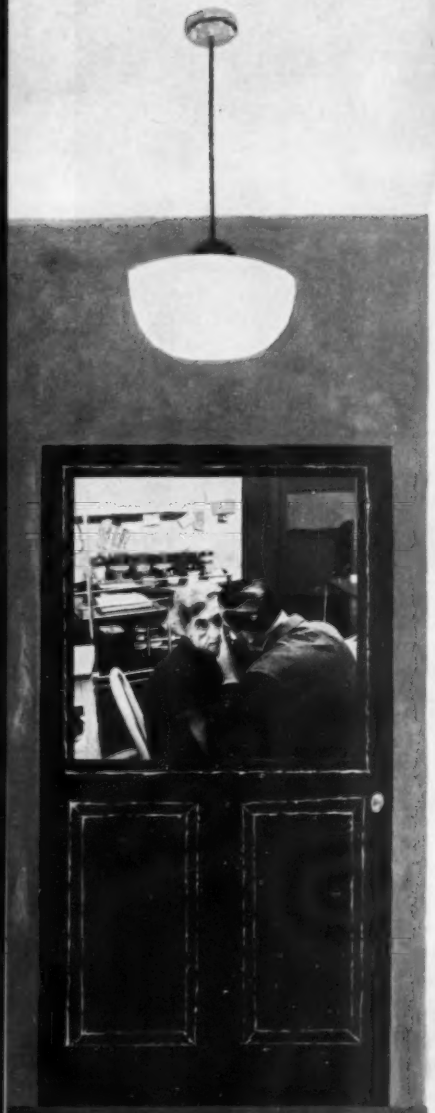

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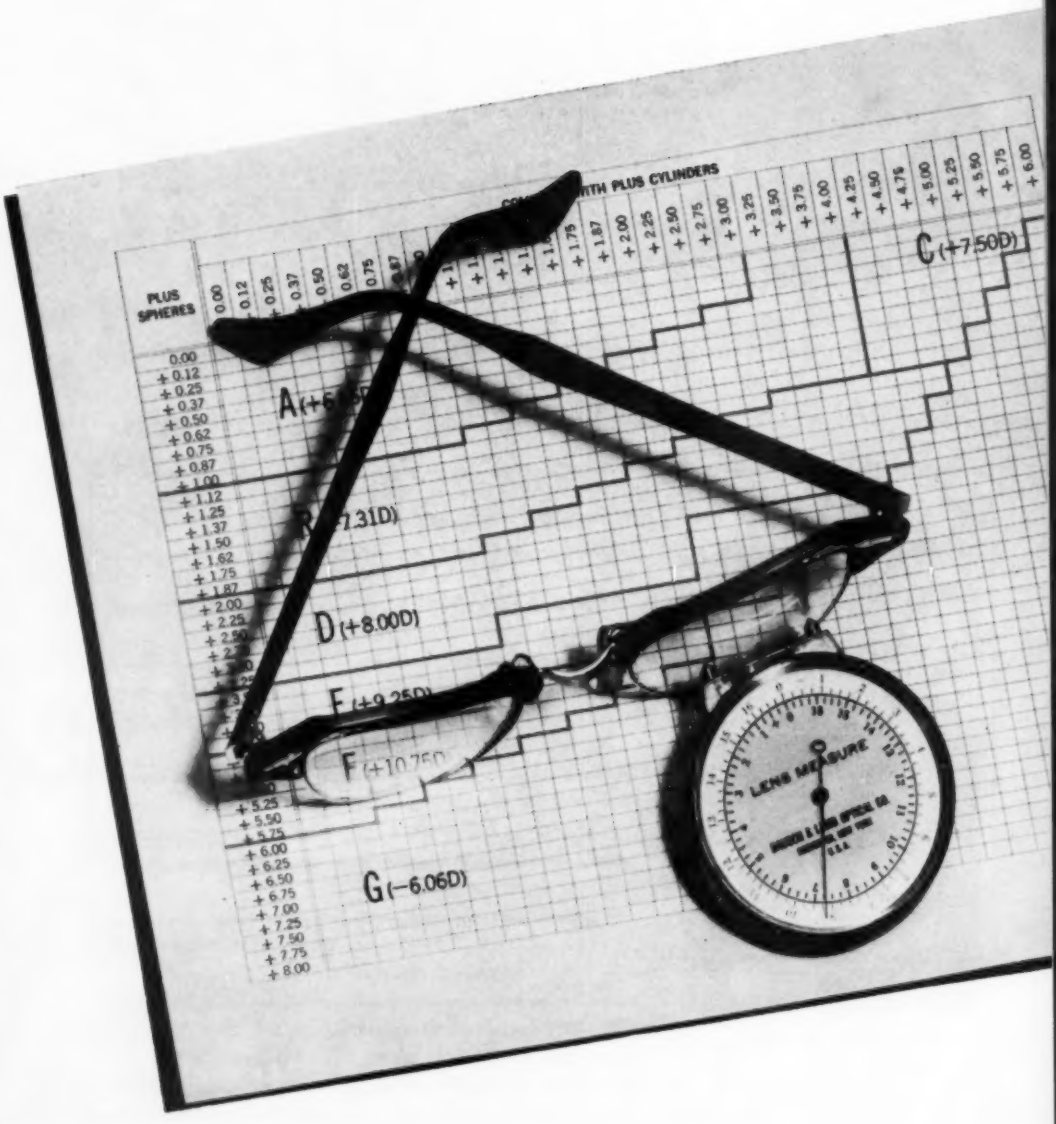

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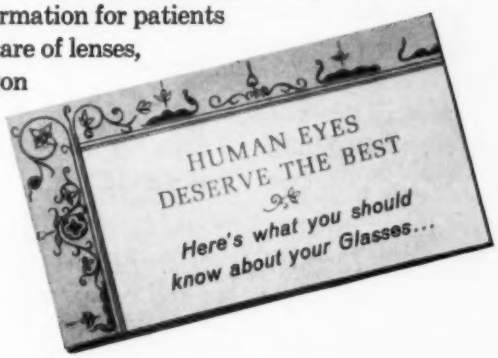

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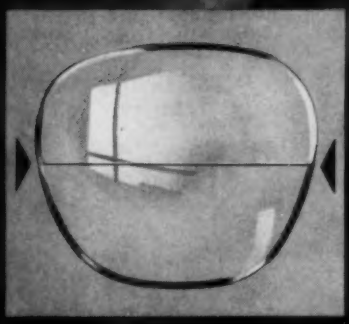

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*Sloan L. L.: New Test Charts for the Measurement of Visual Acuity at Far and Near Distances. American Journal of Ophthalmology, 48:807-813, (Dec.) 1959.

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AMERICAN JOURNAL OF OPHTHALMOLOGY
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A CLINICAL STUDY OF THE USE OF INTRAVENOUS UREA IN GLAUCOMA*

ROBERT C. TARTER, CAPT. USAF (MC), AND JAY G. LINN, JR., M.D.
Pittsburgh, Pennsylvania

INTRODUCTION

The desirability of reducing the intraocular pressure to a normal or subnormal level at the time of surgery has been known for almost as long as surgery for glaucoma has been performed. Hypertonic salt solutions and osmotic agents have been recommended by many authors throughout the years. Most of these agents, however, have side-effects, toxic effects or other disadvantages that have prevented their general use by all ophthalmologists, and many have ceased to be used at all. The use of intravenous urea for the reduction of cerebral volume, reported by Javid and Settlage in 1956[1] led to our interest in the use of this agent in resistant cases of acute glaucoma.

Urea has been extensively used in neurosurgery. Cerebral edema is a very serious complication of neurosurgical procedures which not only makes the operation difficult, but also has been the cause of death postoperatively in many cases. Numerous articles have been written on this subject by Javid and his co-workers and in a summary of his work, he has reported the results on 350 patients.[2] Urea was used on one or more occasions in the same patient with great success. He has carefully outlined the routine to be followed in administering the urea in order to avoid complications, and his complications have been insignificant.

The use of urea in ophthalmology has been reported by Galin and his co-workers.[3-6] They have found a pronounced reduction in ocular tension from intravenous urea. This is prompt and results regardless of whether previous medication was effective. The reduction of ocular tension among glaucoma patients occurred in 30 to 45 minutes and was maintained for five hours. In one patient receiving intravenous urea and sucrose, the response to urea was much greater and more lasting than to sucrose.[5]

Oral urea was also tried, although masking the taste presented a great problem.

Any molecule transfers into the eye by many routes and there are many factors which determine both the site of transfer and the degree of penetration of the molecule into the eye. The principal site of penetration is the ciliary body region through the ciliary processes by secretion or diffusion into the aqueous humor of the posterior chamber. A second site is through the iris blood vessels by diffusion into the anterior chamber. A third site, seldom mentioned, is through the retina by diffusion from the retinal and choroidal blood vessels into the vitreous body.

MODE OF MOLECULAR TRANSFER

Molecules of salts, sugars, and other substances enter the eye by various ways:

1. *Secretion.* Secretion is a penetration into the eye through the cellular membrane

* From the Department of Ophthalmology of the University of Pittsburgh, School of Medicine. This study was supported in part by a grant from the Ophthalmic Foundation of Pittsburgh. The urea used in the study was supplied as Urevert™ by Thomas A. Garrett, M.D., of Travenol Laboratories, Inc., Morton Grove, Illinois. Contents reflect the personal views of the authors, and are not to be construed as a statement of an official Air Force policy.

which is located in the ciliary processes and, hence, all substances entering by secretion, pass through the ciliary epithelium into the posterior chamber.

2. *Diffusion.* This is a penetration directly from the small blood vessels. The rate of penetration will vary greatly with the molecular size and osmotic and hydrostatic pressure. Some diffusion takes place in the ciliary body, iris vessels, and through the retinal and choroidal vessels.

3. *Simple flow.* Some molecules penetrate by a simple flow between the cells rather than by either secretion or diffusion. This route between the cells has been considered the most unselective mode of entrance into the eye and involves passage of the substance through all areas of penetration.[7, 8]

The various molecules penetrate the eye predominantly by one of these methods, although penetration may be demonstrable to a lesser degree by one of the other methods. When a molecule is present in high concentration, certain characteristics influence the site, mode, and rate of penetration of the molecule into the eye.

1. *Ionization.* In general, ionized salts penetrate the eye readily by secretion.

2. *Lipoid solubility.* Substances which penetrate through the cells of the limiting membrane of the ciliary body are lipoid soluble.

3. *Nitrogen content.* Davson[9] has noted that the nitrogen content of various molecules is much more important than the molecular size in those compounds that are not lipoid soluble. Substances with a high nitrogen content fail to penetrate well. Therefore, urea penetrates no better than creatinine, which has twice the molecular size. Sucrose, with a molecular size almost six times that of urea, pentrates well by a simple flow mechanism, but urea penetrates poorly.[10]

4. *Osmotic pressure.* The osmotic pressure relations on both sides of the membrane are the fourth factor to consider in the rate of transfer. The increased osmotic pressure of the blood has been shown to be directly related to the degree of lowering of intraocular and cerebrospinal fluid pressure.[11] Of further importance in the effect of urea on the intraocular pressure is the fact that its diuretic action is not necessary in order to produce the hypotensive effect. Additional monkey experiments by Javid and Anderson[12] have shown that the drop in the cerebrospinal fluid pressure, which parallels to a great extent the drop in ocular tension, occurred after the administration of urea, even when bilateral nephrectomy had been performed. In contrast to normal monkeys the reduced pressure was sustained in this group. This demonstrates that initial diuresis is not as important in creating the desired reduction of intraocular pressure, but is more of a factor in sustaining the hypotensive effect.

Characteristics of urea

Urea is an agent superior to all others previously used for the rapid reduction of intraocular or cerebrospinal fluid pressure.

1. *Toxicity.* Urea is a normal product of body metabolism. It is relatively nontoxic in pure form. Sucrose has been shown to cause damage to the cells in the renal tubules.[13] There is a recovery from this injury, but permanent damage can result from repeated administration. Even sodium chloride in hypertonic doses has been considered toxic because of the secondary rise in the intracranial pressure which has resulted following infusion.[14] No such side-effects result from urea. However, it is essential that the urea solution is fresh. The use of an invert sugar solution as a solvent is recommended because it prevents any hemolysis of erythrocytes from the infusion.

2. *Ocular penetration.* A particular feature of urea is its poor penetration of the eye. This has been noted by numerous experimental studies.[8, 9, 15, 16] There is much better penetration of urea into the vitreous than into the aqueous, because there is considerable resistance to the passage of urea through the secretory mechanism of the ciliary body. This is due to its poor lipoid solubility, as well as its high nitrogen content. Being a nonelectrolyte, urea tends to penetrate the

vitreous more rapidly because it has been demonstrated that nonelectrolytes are rapidly absorbed by the lens and vitreous.[8]

3. *Diuretic action.* Urea has long been known as a very potent diuretic. If kidney function is good, considerable water will be removed from the body. It thus follows that if fluid intake is restricted, this diuretic action, in turn, brings about dehydration. Dehydration has a secondary beneficial effect in sustaining a reduction of intraocular pressure inasmuch as it will reduce aqueous flow.

Materials and Methods

Intravenous urea was administered to 38 patients having glaucoma, the majority of whom were from the Glaucoma Clinic of the Department of Ophthalmology, University of Pittsburgh School of Medicine. A few were private patients of the staffs of the Eye and Ear Hospital and other local hospitals. Three patients with retinal detachment received urea during surgery. The solution used for the infusion was a freshly mixed solution of urea dissolved in 10-percent invert sugar (Travert®) as recommended by Javid.[2]

The dosage recommended by him was followed closely, that is, an average of 1.0 gm. of urea per kg. of body weight. A larger dose was administered to two patients. Fluids were restricted during administration. It was found necessary to insert an indwelling catheter in all patients to handle the sudden and profuse diuresis that always resulted. A 30-percent solution of urea was administered in about one-half hour. When surgery was to be done, the administration was timed to be given between 1.5 and 2.0 hours prior to surgery. This permitted surgery to be performed during the optimum reduction of intraocular pressure. The rate of infusion was 90 to 120 drops per minute. The patients included acute angle-closure, chronic open-angle and absolute glaucoma. Treatment for the glaucoma prior to the urea infusion varied in these three groups. Additional medication was administered during the infusion in order to control some of the side reactions to this form of treatment. These included one of the phenothiazine drugs and a narcotic.

Acute angle-closure glaucoma

Intravenous urea was administered to 14 patients with acute angle-closure glaucoma. Surgery was performed on nine of these. All were hospitalized in the Eye and Ear Hospital. Intravenous acetazolamide, 500 mg., was given on admission, to be followed with 500 mg. orally and continued on 250 mg. orally every four to six hours. Miotics were used topically and usually represented a strong miotic or a combination of miotics, such as carbachol (1.5 percent) or pilocarpine (2.0 to 4.0 percent) and, in some instances, along with eserine salicylate (1.0 percent). These were instilled into the eye every 15 minutes for one hour and every two to three hours thereafter. In a few patients, epinephrine bitartrate (2.0 percent) was used in addition to the miotics at the rate of about one drop every four hours. Numerous other patients with acute glaucoma were handled with this combination of drugs during the period of this study but all patients whose tension returned to normal were eliminated from the study of the use of urea. The 14 reported represented those that did not respond satisfactorily to the above treatment. The duration of treatment prior to urea infusion varied from three to 24 hours, and in this group averaged 17.5 hours before the urea infusion. There was an average drop of tension of 35 mm. Hg (Schiøtz) as a result of the preliminary treatment prior to the urea infusion (fig. 1). Surgery, when performed, was done within one and a half hours of the urea infusion (dotted line). The additional reduction of tension at the time of surgery represents the effect of retrobulbar injection and bulbar pressure. The technique of retrobulbar injection used has been previously described by Everett, et al.[17]

This demonstrates that the hypotensive action of urea not only does not interfere with the tension reducing effect of a retrobulbar

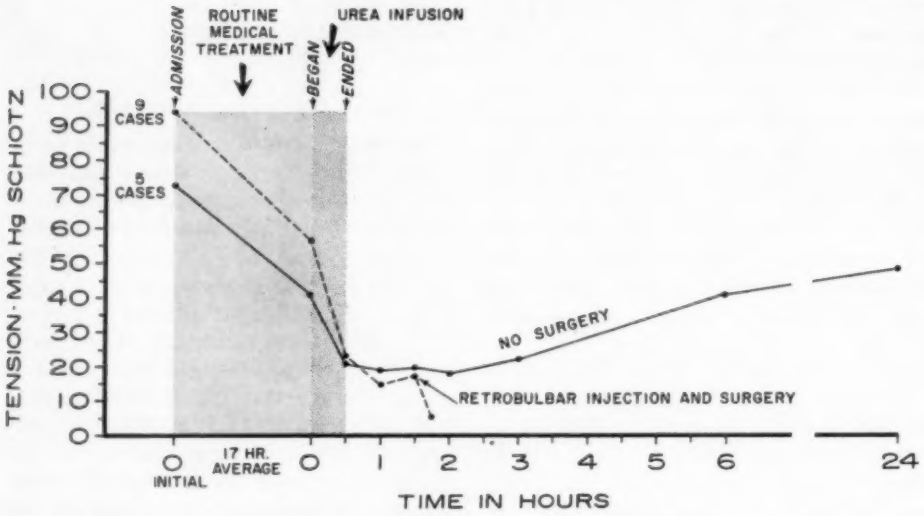

Fig. 1 (Tarter and Linn). Tension curve in acute glaucoma. The dotted line indicates those patients who underwent surgery. The solid line represents patients on whom surgery was not done, but who were continued on miotic therapy.

anesthetic injection, but also is quite effective regardless of the previous routine therapy for the acute glaucoma. Surgery was not done in five patients in this group, and these afforded an opportunity to record the duration of the hypotensive effect of the infusion. The maximum reduction of tension lasted about three hours, with a gradual return to the original tension in six hours. This duration of action corresponds with the findings of previous investigators.

During the course of the treatment of these patients with urea it was noted that the anterior chamber became deeper as the cornea cleared and the tension fell. This observation was made by several examiners on different patients in the series reported, and was an unexpected finding.

Chronic open-angle glaucoma

Urea was administered to a group of 12 patients who had chronic open-angle glaucoma. All of these cases had been controlled on miotics with the exception of one who required the addition of a carbonic anhydrase inhibitor. The rapidity of the effect of urea and the time of the lowest tensions were essentially the same as in the acute glaucoma group. The tension returned to the pre-urea level in about three to four hours (fig. 2). Most of these cases were under good control before urea infusion and, therefore, the initial pressure was not elevated. There was not as dramatic a fall in the ocular tension as that noted in acute glaucoma, but the duration of hypotension was about the same. In five of these patients it was noted that a more profound hypotensive effect resulted from the urea if the fluid intake of the patient was restricted for 12 hours prior to the infusion.

Absolute glaucoma

A urea infusion of standard dosage was administered to nine patients with monocular absolute glaucoma. They were observed in the hospital for six hours during this study. In some of these, there was a pronounced fall in the ocular tension, but in others there was little or no fall.

This lack of response was an unexpected observation. When the nine patients of this group were divided according to the duration

of no light perception it was found that a duration of seven years or more was associated with little or no response to urea infusion (fig. 3). If the absolute glaucoma had existed less than seven years, there was a pronounced fall in the tension in all patients similar to that in acute glaucoma. Of the four patients with absolute glaucoma over seven years, the fall was very slight in three and no change in tension was noted in the fourth. The maximum fall in this group was 20 mm. Hg in the first hour.

Since urea cannot penetrate the eye, through the normal channels of aqueous secretion, except in very small amounts, it must enter through the choroidal and retinal circulation. It is well known that choroidal and retinal circulation are retained in the early stages of absolute glaucoma, even though they may be reduced. But as time progresses and the ocular tissues undergo atrophy, there will be a permanent loss of both of these intraocular circulatory systems. This finding in absolute glaucoma substantiates other studies which have demonstrated the site of penetration of urea into the eye.

The frequent use of scleral shortening and scleral buckling procedures in retinal detachment surgery at times has introduced the problem of completion of the buckling be-

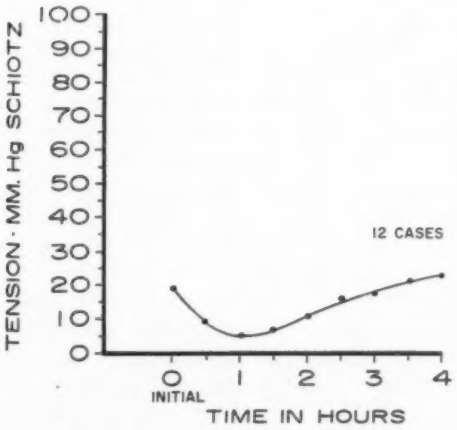

Fig. 2 (Tarter and Linn). Chronic open-angle glaucoma.

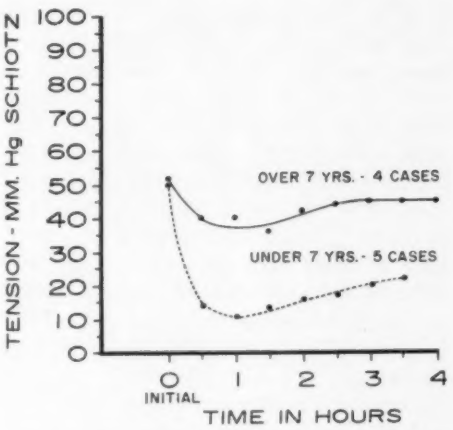

Fig. 3 (Tarter and Linn). Comparison of the hypotensive action of urea in absolute glaucoma with no light perception, of recent occurrence or of long duration.

cause of the great increase in intraocular pressure as the total intraocular volume is reduced. Evacuation of subretinal fluid, as well as a paracentesis of the anterior chamber, is frequently insufficient to facilitate an adequate buckling procedure. Intravenous urea was used on three patients at the time of retinal detachment surgery. The usual dosage of urea was administered. The administration of urea was begun before or shortly after anesthesia, actually about one and a half hours prior to the estimated time the buckling procedure would be performed. The area of buckling in these patients varied between 90 and 360 degrees. It was felt that there was a definite reduction in vitreous volume and the surgeons believed that the surgical procedure was performed with less difficulty than usual, particularly in the cases in which the larger area of buckling was performed. This was an entirely subjective observation in an extremely small series of surgical cases.

Side-effects and complications

Previous reports of the clinical use of urea have minimized discussion of side reactions and complications. Javid and his co-

workers[1,2] have emphasized that stale solutions of urea decompose to form free ammonia, and therefore have recommended the exclusive use of freshly prepared solutions. They have also emphasized the fact that, when mixing the solution with the invert sugar, the solution should not be warmed above 50°C., as ammonia will be formed and this will, in itself, have a toxic effect. We have followed these instructions explicitly: all solutions were mixed immediately before use, and all solutions were not warmed excessively in preparation. The majority of the effects must be considered to be the result of the physiologic effects of a high blood urea level because, in most instances, they disappear when the blood urea level has been reduced after completion of the infusion.

1. *Uncontrollable diureses* (100 percent). As long as the kidney function of the patient is not greatly impaired, a massive diuretic action occurs from the large amount of urea. The urine excretion is so rapid that, in the younger patients, prompt access to a lavatory is necessary. In the older patients, the act of micturation follows the urge so closely, that any distance is too far. Therefore, it is advisable to use a retention catheter in all patients receiving intravenous urea. The catheter is only necessary for approximately three hours. All but three patients of this series were catheterized and no complications resulted.

2. *Headache* (92 percent). During the administration of intravenous urea, headache occurs as the ocular tension falls, due to the obvious dehydration. This can range from a dull pain in the neck to an unbearable throbbing headache. Onset is within five minutes after the infusion begins and lasts as long as 45 minutes after completion. This symptom appears to be a direct result of cerebral shrinkage from urea. It can be terminated in four to five minutes by allowing the patient to ingest water as he desires. However, if this is done the purpose of the urea infusion is defeated, for hydration of all tissues, including the eyes, results. This rather severe symptom experienced by the patient was controlled by small doses of a narcotic combined with one of the phenothiazine drugs. We found that a combination of meperidine, 25 mg., with either promethazine, 25 mg., or trifluprom azine, 10 mg., was beneficial. A combination of either of these and meperidine reduced the intensity of the headache when injected directly into the tubing immediately after beginning the infusion.

3. *Arm pain* (84 percent). Wrist veins were used for the infusion. Some pain in the entire arm occurred in 84 percent of the patients during this infusion. This followed the course of the vein, was most severe in the antecubital fossa, and was described as a cramping sensation relieved within a few minutes after completion of the infusion. Arm pain was also reduced in severity, but not completely eliminated, with the same medications used to control the headache.

4. *Nausea and vomiting* (31.5 percent). This began about one-half hour after beginning infusion. The onset occurred at the time of completion of the infusion and persisted for five or 10 minutes. Prophylactic use of phenothiazines reduced but did not completely eliminate these symptoms.

5. *Mental confusion and disorientation* (21 percent). These psychotic symptoms began with auditory and visual hallucinations about one-half hour after the infusion was started and were associated with an extreme hyperactivity. Five of this group of eight patients had already received the usual preoperative medication for ocular surgery. Control of this adverse effect was obtained by prompt intravenous pentobarbital, which did not affect the intraocular pressure. The confusion and disorientation did not necessarily follow the stage of greatest dehydration indicated by the lowest ocular tension, but frequently appeared before completion of the infusion. It was felt that this was primarily related to the level of the blood urea nitrogen and perhaps also to cerebral dehydration. All patients recovered completely with no permanent mental changes.

6. *Thrombophlebitis* (5.2 percent). Certainly thrombophlebitis is not an unexpected complication of intravenous administration of any chemical in high concentration. Thrombophlebitis following the use of intravenous urea solutions has been reported occasionally.[2,18,19] Impurity of the prepared solution has probably been an important factor in many of these reported cases. However, thrombophlebitis will occasionally result even with a pure, freshly made solution. This happened in one case reported by Javid and in two of our patients. In these patients, the arm pain noted during the infusion persisted after completion of the infusion. There was a mild generalized edema of the arm with some ecchymosis of the forearm. This could have suggested some extravasation from the vein, although no such complication had been noted during the infusion. A blood culture on one of these patients failed to reveal any bacteremia. Warm compresses, plus intramuscular trypsin, produced a spontaneous recovery in both patients in less than a week.

7. *Hyperthermia* (2.6 percent). Hyperthermia began in one patient about 20 minutes after onset of the infusion. After an additional 15 minutes, the temperature had risen to 103°F. rectally. At this time an intravenous infusion of five-percent dextrose solution was begun at a rapid flow, that is, 120 drops per minute. The temperature remained at 103°F. for two hours. A total of 1,800 cc. of this solution was given and all other vital signs remained normal during the period of hyperthermia.

The urea effect was nullified by the treatment for this complication. Possibly this hyperthermia resulted from a urea effect on the hypothalamus. The advanced age of this patient (86 years) was considered a factor. Steffensen[18] reported two cases of temperature rise in his series. His patients were young healthy adults. In neither case reported by him did any permanent harm result. The occasional occurrence of hyperthermia certainly should not be considered a contraindication to the use of urea on the basis of evidence available at the present time.

Comment

The effectiveness and value of urea in ophthalmology and neurosurgery is well established. Some additional understanding of the mode of action of urea in reducing intraocular and cerebrospinal fluid pressure is revealed in this study. The clinical observation that the anterior chamber of the eye deepens as the reduction of the intraocular pressure occurs during urea infusion suggests that fluids are removed from a posterior route, rather than from the anterior chamber, thus permitting the anterior chamber to deepen. The experimental studies previously cited,[9,10,15,16] support this posterior site of penetration of urea into the eye, and hence a posterior site of removal of fluid from the eye.

The studies on the absolute glaucoma patients showed a lack of urea effect if light perception had been absent seven years or longer. In one patient light perception had been absent for more than 20 years and the urea infusion had no effect on tension. These eyes must be considered to have been in various stages of phthisis bulbi with absence of all intraocular circulation. This substantiates previous studies that have indicated the site of action of urea to be the retinal and choroidal circulation. Thus urea is unique as an ocular hypotensive agent because it acts by means not utilized in any other type of treatment for glaucoma.

It is also interesting to note that urea does not interfere with any other method of reducing intraocular pressure. Even the use of a retrobulbar injection of an anesthetic solution will be effective after the maximum urea effect has been obtained. It is our experience that this additional effect of retrobulbar injection might not have been possible prior to the urea infusion. Evidence for this is the ineffectiveness of anesthetic solutions in patients with very high tensions.

The numerous side reactions noted in this study in no way suggest that urea should not be used in the reduction if intraocular pressure, because no permament damage resulted. However, it must be noted that additional sedation is advisable in order to prevent many of the uncomfortable symptoms that will occur during treatment. Actually, it seems unlikely that any serious complication of this therapy would result, except in the presence of an almost complete state of renal failure. Therefore, the blood urea nitrogen should be determined prior to urea infusion. A high blood urea nitrogen level does not necessarily interfere with the hypotensive effect of urea, but would only add to the toxic manifestations.

Conclusions

This study has confirmed those previously reported which have demonstrated the effectiveness of intravenous urea in lowering the intraocular pressure in acute angle-closure glaucoma. Studies on patients with absolute glaucoma have corroborated experimental studies which have indicated that the site of action of urea is through the retinal and choroidal circulation, and therefore, does not affect the action of other measures used to reduce intraocular pressure. Urea acts primarily by increasing the osmotic pressure of the blood and secondarily by dehydration as a result of diuresis. Supplemental analgesics and sedatives minimize side-reactions during urea infusion.

Summary

An analysis of a study of the use of intravenous urea in 38 patients has been presented in detail. The value of urea in the treatment of acute angle-closure glaucoma has been confirmed. The site of action of urea and its mode of action have been indicated in the results of administration of urea in the various types of glaucoma patients. The complications and side reactions observed during urea administration have been considered, as well as their method of control.

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CLINICAL EVALUATION OF LOCAL OCULAR ANTICHOLINESTERASE AGENTS IN MYASTHENIA GRAVIS*

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The not infrequent occurrence of residual ocular signs in myasthenia gravis patients who are otherwise well controlled by systemic medications prompted Leopold, et al.,[1] to employ local anticholinesterase agents in the eye.

This report deals with a series of 10 myasthenia gravis patients seen in The University of Michigan Medical Center between November, 1959, and March, 1960, who were treated with local, ophthalmic application of anticholinesterase drugs.

HISTORICAL BACKGROUND

Although ephedrine was first found to be empirically effective in the treatment of myasthenia gravis in 1930 by Harriet Edgeworth, physostigmine (or eserine) proved to be much more dramatic in its effects when it was first discovered by Mary Walker in 1934. Since that time, other cholinergic drugs which depend on their inhibition of cholinesterase at the myoneural junction have become the standard therapy in the management of myasthenia. Those in use today include neostigmine (Prostigmin), pyridostigmin (Mestinon), and ambenomium chloride (Mytelase). The organic phosphates, di-isopropylfluorophosphate (DFP), hexaethyl tetraphosphate (HETP), octamethyl pyrophosphoramide (OMPA), have also been shown to be effective both orally and parenterally in controlling myasthenic symptoms but because their bond with cholinesterase is an irreversible one, the duration of action is great, and the cumulative effect is difficult to control. Their clinical use has been abandoned in favor of the drugs which have a reversible union with cholinesterase and a shorter period of action and which, therefore, lend themselves to a more easily manipulated dosage schedule.

Since ordinarily only the mildest cases of myasthenia gravis are completely restored to normal strength by means of these medications, the majority of patients are left with residual paresis even on optimum dosage. While correction to 80 percent or 90 percent of normal motor power may be satisfactory in the muscles of the extremities and may be compatible with useful activity, the presence of even slight residual weakness in extraocular muscles is of major concern to the patient, limiting occupational and recreational activities. There are, moreover, patients with only ocular involvement of the myasthenic process in whom systemic ther-

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apy may not be necessary or satisfactory. For these two groups local treatment would be a welcome addition to oral therapy if it could offer improvement.

Therapeutic agents

Di-isopropylfluorophosphate (DFP) and physostigimine (eserine) were used in this study. Both of these drugs, unlike neostigmine, have no direct muscle stimulating action but depend entirely on the inactivation of cholinesterase and the accumulation of acetylcholine in the tissues for their effect. Damiani[2] and Leopold have reported that both extraocular muscles and the levator palpebrae can be altered by the use of local neostigmine and demecarium bromide. Since all of these drugs exhibit muscarinic as well as nicotinic reactions and affect smooth muscle as well as striated, miosis, ciliary spasm, follicular conjunctivitis, and pupillary border iris cysts as well as allergic blepharitis may occur. After the instillation of eserine, pupillary contraction occurs within minutes and is maximal after 30 minutes. It may persist for several days. With local instillation of DFP the miosis produced may last as long as 27 days. Ciliary spasm and extreme miosis may be bothersome because of discomfort and reduced illumination. Both may be relieved by the use of atropine. Dilatation of the capillaries of the iris and ciliary body also occurs and may precipitate a congestive narrow-angle glaucoma in patients with anatomically narrow drainage angles. Iris cyst formation is commonplace with the use of DFP.

The eserine used was the commercially available 0.25-percent concentration in both drop and ointment form. The DFP was Fluoropyrl (Merck, Sharpe and Dohme)* and is available in a 0.25-percent ointment and a 0.1-percent solution.

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* We wish to thank Merck, Sharpe and Dohme for the generous supply of Fluoropryl used in this study.

Analysis of cases

1. Selection of patients

The 10 patients examined in this series were all known cases of myasthenia gravis of varying duration with residual ocular signs and symptoms remaining after treatment of the general disease had been undertaken with the use of systemic medications. The duration of the disease varied from six months to 18 years and all of the patients had been stabilized on optimum dosage of oral preparations for several months or years.

2. Initial examination

At the time of the first examination a detailed ocular history was obtained. Of special interest was the amount of diplopia, ptosis and blurring noted by the patient and the degree of incapacitation resulting from these signs. The usual period of comfortable reading time and the variability of the ocular signs and symptoms were also carefully recorded.

A complete routine ocular examination was performed. Of particular interest to this study were extraocular muscle and palpebral fissure measurements and gonioscopic findings.

Gonioscopy was performed in all except one patient (see Case 8) in order to rule out the presence of a narrow outflow channel. This was considered necessary because of the well-known propensity of anticholinesterase agents to produce ciliary body congestion and acute narrow-angle glaucoma.

After completing this examination and finding open angles, the patient was given one of the weaker anticholinesterase agents to use by local application in both eyes. At first, 0.025-percent DFP was used as the initial agent in starting treatment but because of unfavorable side-effects, eserine (0.25-percent) later replaced it as the drug of choice.

Each patient was carefully instructed in

the self-administration of the ointment and advised to expect some irritation and difficulty with the use of the drug and to advise us immediately should any severe pain or inflammation occur. Ciliary spasm, difficulty in dim lighting, miosis and browache were all carefully reviewed with the patient as "usual" side-effects.

3. Follow-up-examinations

Early in the study the patients were seen at one to two-week intervals and the following measurements made: (a) visual acuity, (b) tonometer tension, (c) palpebral fissures, (d) extraocular deviations, (e) pupil size, and (f) presence and size of iris cysts.

The patients were asked whether or not they thought their ocular status had changed and what, if any, side-effects were noted. These last two facets require further discussion.

Because the nature of myasthenia gravis is such that daily fluctuations are the rule rather than the exception, it is difficult to evaluate fully the effect of therapy at a single or even multiple visits. It thus becomes necessary to record a subjective response in addition to objective measurements in order to obtain a more complete picture.

The extent of side-effects is important in deciding future therapy. From a purely practical standpoint, if the side-effects are severe it may be necessary to discontinue or modify treatment in spite of an apparently good clinical response. The extreme miosis and ciliary spasm often associated with the use of the medications may be sufficiently severe to offset any beneficial effect that results from the agents.

4. Response to treatment

The results of therapy in these 10 cases fall into four categories:

Group 1. Treatment tolerated, patient improved.

Group 2. Treatment tolerated, patient unimproved.

Group 3. Treatment not tolerated, patient improved.

Group 4. Treatment not tolerated, patient unimproved.

The improvement in these cases can be objectively quantitated on the basis of the amount of ptosis since all of the patients in this series exhibited moderate to marked ptosis of one or both upper lids. Improvement in diplopia and blurring of vision was more difficult to evaluate though subjectively several patients noted a decrease in these signs.

The frequency of each of the signs is listed in Table 2. Out of the 10 cases of ptosis, seven were bilateral and only two unilateral.

Five of the 10 patients fall into Group 1 (treatment well tolerated and patient improved), one into Group 2 (treatment tolerated but patient unimproved), two into Group 3 (improved but not tolerated) and two into Group 4 (drugs neither tolerated nor patient improved, table 3).

5. Case summaries (table 1)

Group 1

Case 1

E. S., a 61-year-old man, had a diagnosis of myasthenia gravis first made in 1956 by his local ophthalmologist. He was subsequently seen at The University of Michigan Medical Center by the Neurology Department and treated with several different agents. At the time of his initial ocular examination in this study he had been taking Mytelase (50 mg.), ephedrine and Mestinon (90 mg.) for a period of two years. With these medications his myasthenia was well controlled except for ocular involvement consisting of bilateral ptosis, intermittent diplopia and blurring of vision occurring each afternoon.

Pertinent ocular findings on November 12, 1959, included a corrected visual acuity of 20/20, O.U., grade II open angles gonioscopically, an intermittent exotropia of 10-15$^{\Delta}$ and palpebral fissures which measured 8.0 mm., O.D., and 9.0 mm., O.S. with effort. Tonometer tensions were normal.

He was given DFP (0.025 percent) ophthalmic ointment and instructed to use it nightly.

TABLE 1

DURATION OF MYASTHENIA GRAVIS, DOSAGE AND TYPES OF SYSTEMIC MEDICATIONS USED AND RESIDUAL OCULAR SYMPTOMS PRESENT IN THE 10 PATIENTS ANALYZED

Case No.	Patient's Initials	Age (yr.)	Years M.G.	Daily Systemic Medications	Period of Medications	Residual Ocular Symptoms
1	E. S.	61	4	Mytelase 50 mg. Ephedrine Mestinon 90 mg.	2 yr	Ptosis O.U. Blurring Diplopia
2	P. K.	33	9	Mestinon 520 mg. Ephedrine 75 mg.	1 yr.	Ptosis O.U. Blurring Diplopia
3	K. H.	55	11	Mestinon 540 mg. Mytelase 75 mg. Ephedrine	3 mo.	Ptosis O.U. Diplopia
4	P. S.	32	18	Mytelase 275 mg.	2 yr.	Ptosis O.U. Blurring Diplopia
5	E. P.	19	½	Mestinon Prostigmine Ephedrine-Amytal	1 mo.	Ptosis O.S. Diplopia
6	S. R.	32	3	Prostigmine 105 mg. Mestinon 840 mg. Ephedrine Pot. Chloride 3.0 gm.	2½ yr.	Ptosis O.S.
7	M. S.	31	5	None	—	Ptosis O.D. Blurring Diplopia
8	S. M.	17	14	Mytelase 115 mg. Ephedrine	3 yr.	Ptosis O.U.
9	M. L.	71	5	Mytelase 75 mg.	3 yr.	Ptosis O.U.
10	E. S.	50	9	Mestinon	2 yr.	Ptosis O.U. Intermittent diplopia

The patient returned one week later and reported that he was "the closest to normal that he had been since the onset of my myasthenia." His diplopia was present only in the late afternoon and he stated that his ptosis had all but disappeared.

Examination revealed normal visual acuity, palpebral fissures of 14 mm. O.U., and no exotropia.

Treatment nightly was continued for an additional week and another examination revealed no change. The medication was decreased to every other night.

After one week of treatment using 0.025-percent DFP every other night the patient noted a return of ptosis and intermittent diplopia.

After varying the dose over the next month the patient reported an excellent response using his medication three to four times weekly. On March 6, 1960, after returning from a two month vacation, during which period he used the drug every other night, no ptosis, tropia or iris cysts were seen.

TABLE 2

PERCENTAGE OF PATIENTS EXHIBITING OCULAR SIGNS AND SYMPTOMS

Signs and Symptoms	Number	Percentage
Ptosis	10	100
Diplopia	7	70
Blurring	4	40

TABLE 3

CLASSIFICATION OF THERAPEUTIC RESPONSES

Group	Number	Definition
1	5	Treatment tolerated Patient improved
2	1	Treatment tolerated Patient unimproved
3	2	Treatment not tolerated Patient improved
4	2	Treatment not tolerated Patient unimproved

A trial of a placebo ointment was started at that time and one month later his palpebral fissures measured 9.0 mm., O.D., and 4.0 mm., O.S., a wide exophoria was present and he complained of severe diplopia and ptosis.

On May 5, 1960, one month later, the palpebral fissures measured 10 mm., O.D., and 11 mm., O.S., a small exophoria was present and subjectively his ocular signs were completely absent. The patient was using the drug two to three times weekly and with the exception of a reduction in his Mytelase his systemic medications were unchanged from those used at the start of local treatment.

CASE 2

P. K., a 33-year-old housewife, had been a known myasthenic for nine years. She had been well controlled with Mestinon (480 to 660 mg.) and ephedrine (75 mg.) daily for one year. Her ocular symptoms while on these medications consisted of bilateral ptosis, left eye greater than the right, almost constant diplopia and severe blurring of vision. She was unable to read with both eyes and did not drive.

Initial ocular examination on November 12, 1959, revealed a corrected visual acuity of 20/20 in each eye, grade I to II open angles gonioscopically, 8^{Δ} of right exotropia, palpebral fissures of 8.0 mm., O.D., and 7.0 mm., O.S., with effort and normal tonometer tensions. DFP (0.025 percent) ointment was started nightly.

After one week of therapy she reported slightly less diplopia and no extraocular abnormality was found at the time of the examination. The palpebral fissures were unchanged. The patient complained of dim vision and difficulty with darkly illuminated places with the use of the drugs.

DFP (0.1 percent) drops each night were started on November 25, 1959, because no change was seen after another week of therapy with the use of the lesser concentration.

At the return appointment one week later the patient reported dramatic improvement for three days and then with continued treatment a return of symptoms. Because of this the possibility of a curarizing effect from prolonged action of the drug was suspected and the patient was told to stop all medications for three days, then resume treatment on alternate days. Small cysts were noted at the pupillary margin at that time.

On December 17, 1957, no improvement was seen and further, with the use of the drug every third night, the condition was unchanged. All medications were therefore discontinued on December 24, 1959.

On January 21, 1960, the palpebral fissures measured 6.0 mm., O.U., no tropia was seen and a small iris cyst was present at the pupillary border of the left eye.

Eserine (0.25 percent) ointment once daily in the morning was started at that time and two weeks later the palpebral fissures were 10 mm., O.D., and 8.0 mm., O.S., and the remainder of the examination unchanged. The patient noted improvement of both ptosis and diplopia in the morning but later in the day was bothered by these symptoms once again. The eserine was increased to twice daily and was to be used in the morning and again at 3:00 P.M.

On February 17, 1960, the palpebral fissures measured 9.0 mm., O.D., and 8.0 mm., O.S., and no tropia was present. Aside from blurred vision for two hours after instillation the patient felt definitely improved and was able to function binocularly most of the day.

After three months of changing from drops to ointment then back to drops again in the same concentration of eserine (0.25 percent), the patient's palpebral fissures were 10 mm., O.U., an intermittent right exotropia was present though subjectively less diplopia was experienced and small iris cysts were present in the right eye. Eserine (0.25 percent) drops were used at noon and 6:00 P.M. and 0.25-percent ointment before retiring for the two-week period preceding this examination on May 5, 1960.

The patient was instructed to continue with this treatment program and to return in two weeks. No change in her systemic medication occurred during the period of observation.

CASE 3

K. H., a housewife, had a diagnosis of myasthenia gravis first made in 1949. Her myasthenia was moderately severe but fairly well controlled with oral medications (table 1). She was bothered by bilateral ptosis, the right eye worse than the left, and diplopia. Her ophthalmologist had prescribed prisms for incorporation into her glasses in an attempt to facilitate binocular vision. At the time of her first examination on November 12, 1959, she arrived with eight pairs of spectacles, all with varying amounts of horizontal and vertical prisms to correct her varying extraocular muscle palsies.

Corrected visual acuity at that time was 20/30, O.D., and 20/25^{+}, O.S. The palpebral fissures measured 5.0 mm., O.D., and 4.5 mm., O.S. A right esotropia of 4^{Δ} and hypertropia of 2^{Δ} was measured in the primary position. Tonometer tensions were normal and gonioscopically the angles were open.

The patient was placed on DFP (0.025 percent) ointment nightly.

One week later the patient complained of dim vision and persistent diplopia but had noted less ptosis. A right exotropia of 8^{Δ} and unchanged palpebral fissures were present.

After another week of therapy the palpebral fissures were 9.0 mm., O.D., and 7.0 mm., O.S., and a variable intermittent right exotropia was seen. She was still bothered with browache and "dim" vision.

On December 12, 1959, iris cysts were present in the right eye and all of the findings had reverted back to the pretreatment status. The patient was instructed to use 0.1-percent DFP drops nightly.

With the use of DFP nightly, then every other night and every third night no improvement was noted. After further reducing the dosage to every fourth night a beneficial effect was finally noted.

With the use of the drug every fourth night for two weeks, the palpebral fissures measured 9.0 mm., O.D., and 8.0 mm., O.S., an intermittent exotropia was present and subjectively there was greater tolerance to the drug and less diplopia. This was on March 23, 1960.

During the time of this study, no change in systemic medications occurred and on April 27, 1960, the palpebral fissures measured 8.0 mm., O.D., and 10 mm., O.S., an intermittent exotropia and right hypertropia were present and large iris cysts were seen.

It was planned to watch the patient carefully because of the iris cyst production.

Case 4

P. S., a 32-year-old woman meat cutter, was known to have myasthenia gravis since the age of 18 years. For the two years preceding the initial examination she had been well controlled except for severe bilateral ptosis, blurring and diplopia with the use of Mytelase (285 mg.) daily.

Examination on November 19, 1959, revealed a corrected visual acuity of 20/20, O.U., palpebral fissures of 7.0 mm., O.D., and 8.0 mm., O.S., open angles gonioscopically, normal tonometer tensions and a large exophoria. Diplopia bothered the patient only in the early morning and late evening.

DFP (0.025 percent) ointment daily resulted in no improvement and with the use of 0.1-percent drops severe blurring occurred. In spite of subjectively (though not objectively) less ptosis and diplopia the patient stopped all local medications.

Eserine (0.5 percent) ointment used once daily in the morning was begun on January 25, 1960. On February 10, 1960, the palpebral fissures had increased to 11 mm., O.U., and the patient felt that in spite of a generalized worsening of her myasthenia that her eyes were much improved.

The palpebral fissures one month later measured 13 mm., O.D., and 11 mm., O.S., and no diplopia was present according to the patient. A small exophoria was found at this time.

On April 7, 1960, pupillary border iris cysts were found for the first time and the remainder of the examination was unchanged.

She was instructed to attempt a tapering of the medication if possible and to return at monthly intervals.

No change in systemic mediations were made during the period of observation.

Case 5

E. P., a 19-year-old secretary, had been a known myasthenia gravis patient for six months prior to her first visit to the eye clinic. The patient was well controlled systemically on Mestinon and ephedrine and the only disturbing symptom of myasthenia gravis remaining after one month's treatment was a left ptosis and a bothersome, intermittent diplopia.

Pertinent ocular findings on March 25, 1960, revealed normal visual acuity, gonioscopically open angles, a small exophoria and palpebral fissures that measured 10 mm., O.D., and 8.0 mm., O.S.

After using eserine (0.25 percent) ointment each morning for two weeks then twice daily for another two weeks, no subjective or objective improvement was noted.

On April 22, 1960, the medication was changed to 0.025-percent DFP ointment every other evening. Examination of May 13, 1960, revealed equal palpebral fissures of 10 mm., a small exophoria and a definite marked improvement subjectively in her diplopia.

A reduction to 0.025-percent DFP ointment every third night was advised and the patient asked to return in two weeks.

Comment

Table 4 lists the improvement noted by each patient. All five cases demonstrated larger palpebral fissures, less diplopia and those with previously limited reading tolerance increased their reading time. The follow-up period in each of the first four cases was between five and six months while the last case (5) was followed for about two months.

The systemic medications were either constant or decreased during the period of observation.

Only one patient (Case 1) received placebo drugs and he demonstrated complete reversion to pretreatment ocular status while on the placebo medication. When placed back on the active drug his ocular signs decreased once again. The ability to reduce the systemic medications in this patient was not entirely unexpected and probably occurred because of the system's absorption of small amounts of the locally placed anticholinesterase agents through the nasal mucous membranes.

It is obvious that these patients must be carefully observed and regulated with respect to the ocular medications because of the tendency to production of pupillary border iris cysts. Cases 2, 3 and 4 all had these cysts present at the time of the last examination and it is quite possible that with continued use of the drug and further increase

TABLE 4

OBJECTIVE AND SUBJECTIVE IMPROVEMENT IN THOSE PATIENTS TOLERATING TREATMENT

Case No.	Initial		Palpebral Fissures		Diplopia		Reading Tolerance		Final Treatment
1	E. S.		11–12–59 with effort	5–5–60 with effort	11–12–59 Severe	5–5–60 None	11–12–59 Minutes	5–5–60 Unlimited	0.025% DFP ung. 2–3 times a wk.
		O.D.	9 mm.	16 mm.					
		O.S.	8 mm.	15 mm.					
2	P. K.		11–12–59	5–5–60	11–12–59	5–5–60	11–12–59	5–5–60	0.25% eserine gtts. b.i.d. ung. q. noc.
		O.D.	8 mm.	10 mm.	Severe	Sl. imp.	Monocular Unlimited	Intermittent binocular	
		O.S.	7 mm.	10 mm.					
3	K. H.		11–12–59	4–27–60	11–12–59	4–27–60	11–12–59	4–27–60	0.1% DFP gtts. q. 4 noc.
		O.D.	4½ mm.	8 mm.	Severe	Much Improved	Minutes	Unlimited	
		O.S.	5 mm.	10 mm.					
4	P. S.		11–19–59	4–7–60	11–19–59	4–7–60	11–19–59	4–7–60	0.25% eserine ung. q. a.m.
		O.D.	7 mm.	12 mm.	Occasional	Better	Unlimited	Unlimited	
		O.S.	8 mm.	11 mm.					
5	E. P.		3–25–60	5–13–50	3–25–60	5–13–60	3–25–60	5–13–60	0.25% DFP q. noc.
		O.D.	10 mm.	10 mm.	Frequent	Improved	2–3 hours	Unlimited	
		O.S.	8 mm.	10 mm.					

in cyst formation they will fall into the group (3) who improved but could not tolerate prolonged use of the drug.

Of particular note is the "final" dosage of drug in each patient. None of the five patients who tolerated and improved with treatment was on similar dosage schedule. This serves to emphasize the need for individual adjustment in order to arrive at an acceptable treatment program.

The following brief case summary concerns the only patient in the series who tolerated the treatment but failed to improve objectively:

CASE 6

S. R., a 32-year-old secretary, was first diagnosed as a myasthenic in 1957 and with the exception of a left ptosis had been well controlled with systemic medications (table 1).

On November 12, 1959, the visual acuity was 20/20 in each eye and palpebral fissures measured 15 mm., O.D., and 13 mm., O.S. with effort and 10 mm., O.D., and 8.0 mm., O.S., relaxed. A small exophoria, normal tonometer tensions and gonioscopically open angles were found.

Over the next three months various doses of DFP (0.025 percent) ointment and 0.1-percent drops resulted in intermittent exacerbation and remission of ocular signs and symptoms. All drugs were stopped for one month and on March 10, 1960, the palpebral fissures measured 13 mm., O.D., and 12 mm., O.S., with effort and 9.0 mm., O.D., and 4.0 mm., O.S., relaxed. The remainder of the findings were as on November 12, 1959.

Eserine (0.25 percent) ointment was started on March 10, 1960, and two weeks later the palpebral fissures measured 17 mm., O.D., and 15 mm., O.S., with effort and 10 mm., O.D., and 7.0 mm., O.S., relaxed. Eserine ointment was increased to twice daily and on April 8, 1960, and May 6, 1960, the measurements were unchanged.

Subjectively the patient's ptosis was improved most of the day and the drug well tolerated. Although the palpebral fissure measurements differed only slightly from the original findings (November 12, 1959) subjectively the patient was much improved and comparing the findings at the start of treatment with eserine (0.25 percent) (March 10, 1960) with those of May 6, 1960 a definite improvement was noted.

The third group includes Cases 7 and 8. Both cases improved with treatment but were unable to tolerate the drugs.

CASE 7

M. S., a 31-year-old graduate student, was known to have myasthenia gravis for five years. He was unable to maintain any sustained dosage of systemic drugs because of severe abdominal cramping and diarrhea which accompanied the use of oral medications. In spite of this he did quite well and his most annoying problem was a mild right ptosis, a severe unremitting diplopia and a large right divergent strabismus.

A complete ocular examination revealed a corrected visual acuity of 20/25, O.D., and 20/20, O.S., palpebral fissures with effort of 13 mm., O.D., and 15 mm., O.S., a right exotropia of 40$^{\Delta}$ and hypotropia of 10$^{\Delta}$. Tonometer tension was normal and gonioscopy showed open angles.

On November 12, 1959, DFP (0.025 percent) was started nightly. The patient noted an almost immediate decrease in ptosis and some diminution in diplopia with the use of the drug but on the second day of treatment severe abdominal cramping and diarrhea occurred along with bothersome ocular pain and visual blurring. The patient stopped all medication and when seen one week later the exotropia had decreased to 30$^{\Delta}$, the right hypotropia was still 10$^{\Delta}$ and the palpebral fissures could be opened to 16 mm., O.U. His pupils were 1.5 mm.

No further trial of drugs was instituted in this patient.

Case 8

S. M., a 17-year-old school girl, was known to have myasthenia gravis since the age of three years. Her myasthenia was moderately severe and had been stationary for many years. Bilateral severe ptosis had been present since infancy.

On November 12, 1959, her palpebral fissures measured 5.0 mm., O.D., and 8.0 mm., O.S., 10$^{\Delta}$ of alternating exotropia was seen and normal tonometer tensions were obtained. Gonioscopy was attempted but was impossible. However, because of a deep anterior chamber and the statistically small incidence of acute congestive glaucoma in this age group, she was included in this study.

After one week of 0.025-percent DFP ointment used nightly the palpebral fissures measured 8.0 mm., O.D., and 9.0 mm., O.S., and no exotropia was found. One week later the ptosis had increased; small iris cysts were present. No exotropia was elicited.

The use of DFP (0.1-percent) drops nightly was started on November 29, 1959, and examination one week later revealed palpebral fissure measurements of 7.0 mm., O.D., and 8.0 mm., O.S., 6$^{\Delta}$ of alternating exotropia and large iris cysts practically occluding the central pupillary area in each eye. All medications were therefore stopped.

One month later the findings were similar to those of November 12, 1959, and a small residual iris cyst was present in her left eye.

Comment

Each of these patients showed slight improvement with the use of the local agents but undesirable side-effects dictated cessation of therapy. Case 7 demonstrated an extremely low tolerance threshold to anticholinesterase agents since the use of only 0.025-percent DFP resulted in severe abdominal signs. This was consistent with the previously known intolerance to systemically administered drugs.

The use of ocular agents in the youngest patient in this series, Case 8, resulted in the production of large iris cysts so commonly seen in the treatment of strabismus. This occurrence is probably the most important limitation in the treatment of the patient in the first three decades of life.

The following two case reports illustrate those patients who neither tolerated nor improved with therapy. Case 9 received a self-imposed, very short trial of medication but Case 10 was given a longer period of evaluation.

Case 9

M. L., a 71-year-old retired real estate broker, was known to have myasthenia gravis since 1956. His symptoms were those of ocular involvement only.

Corrected vision on November 6, 1959, was 20/30, O.D., and 20/40, O.S., the palpebral fissures measured 3.5 mm., O.D., and 2.5 mm., O.S., an 8$^{\Delta}$ left exotropia was present and normal tonometer tensions and gonioscopically open angles were found. Early lenticular changes, compatible with the decreased visual acuity, were noted.

DFP ointment (0.025 percent) was started nightly and the patient was asked to return in one week. A telephone conversation on November 13, 1959, revealed that no noticeable improvement had occurred and that severe headaches, blurring and ciliary spasm had caused the patient to stop medication five days after starting it. The patient did not return for further evaluation.

Case 10

E. S., a 50-year-old man, a diabetic, was first diagnosed as a myasthenic in 1951. Severe ptosis and occasional diplopia had persisted in spite of fair systemic control with oral medications (table 1).

The pertinent ocular findings of December 10, 1959, included palpebral fissure measurements of 3.0 mm., O.D., and 2.0 mm., O.S., an intermittent right exotropia, gonioscopically open angles, a corrected visual acuity of 20/25, O.U., and normal tonometer tensions.

Treatment with 0.025-percent DFP ointment nightly for six weeks, 0.1-percent DFP drops daily for a week, then every other day for a month resulted in no improvement. The patient tolerated the drug poorly, never successfully adjusting to the impaired vision in poorly lighted areas and was finally instructed to stop all medications on February 29, 1960.

Discussion

Out of the 10 patients in whom we employed local ocular anticholinesterase agents in the treatment of residual ocular myasthenia gravis signs, five showed some improvement in the degree of ptosis and strength of extraocular muscles objectively and subjectively and were able to tolerate the medication. It is quite possible that with further experimentation and employment of other agents, a larger percentage of these patients may be helped.

Leopold, et al.,[1] showed quite dramatically with the use of electromyography that the application of these local agents resulted in increased activity of the motor units. We have found that DFP and eserine are clinically valuable drugs in a select but significant number of patients and that a trial of such therapy is warranted in patients with persistent ocular symptoms.

At the start of this study it was felt that patients with recent onset of myasthenia would be better candidates for treatment, since secondary muscular changes as a result of disuse might not yet have supervened. This is apparently not the case since the average length of known myasthenia gravis in those patients helped was eight years as compared to seven years in the group unsuccessfully treated. In addition, the age of the patient does not appear to be a significant prognosticating factor. The two areas where the local agents appeared to benefit the patient who tolerated treatment most are in ptosis and diplopia. Where the reading time was diminished, some improvement was noted by all five successfully treated cases.

A difficult concept to grasp in the therapy of these patients is the fact that "if a little drug doesn't seem to help a little less might!" Where a response to a given concentration or dosage of a drug has been minimal it is common practice to increase the concentration and/or dosage of the drug in order to obtain a therapeutic effect. This is not always the case when using the long-acting anticholinesterase agents however. Since the action of DFP is cumulative over a long period, benefit may not be immediate and later reduction in dose may be necessary after improvement has been obtained, since over dosage with any of the agents may increase weakness rather than diminish it.

Suggested therapeutic program

After a definite diagnosis of myasthenia gravis has been made and the patient has been placed on a regular program of oral systemic medications, should bothersome residual ocular signs remain, a trial of local anticholinesterase agents should be undertaken.

The following is a suggested outline of treatment:

1. Complete routine ophthalmologic examination including cycloplegic refraction where indicated.

2. Careful measurement of palpebral fissures, extraocular muscle anomalies, gonioscopy and tonometer tensions.

3. Should the employment of local anticholinesterase be deemed advisable, the patient should be given a lengthy description of the usual and harmful side-effects associated with their use.

4. At the start of therapy the patient should be placed on 0.25-percent eserine ointment each morning and followed weekly for two weeks.

5. A daily diary should be kept by the patient. If no objective or subjective improvement occurs during the first two weeks of therapy then the dosage may be increased to two to three times daily. If a response is not noted with these dosages, then DFP (0.025 percent) ointment should be started nightly.

6. During the entire period of observation tonometer tensions and slitlamp examination should be obtained in addition to the routine measurements. Elevated tensions and iris cysts should be handled in the usual manner.

7. After using DFP (0.025 percent) for two weeks without improvement the concen-

tration may be increased to 0.1 percent. While using DFP the clinician must watch carefully for over dosage. Any improvement, followed by an apparent relapse in signs should make one wonder about overtreatment and curarization.

8. If possible the patients should be followed by a neurologic consultant during therapy or at the very least, such consultation should be readily available.

Summary and Conclusions

1. A detailed analysis of experience with locally instilled ocular anticholinesterase agents in 10 patients with myasthenia gravis is presented.

2. The pharmacology of myasthenia gravis treatment in general and specifically the actions of those drugs investigated, eserine and DFP, is outlined.

3. Out of the original group of 10 patients receiving treatment, five patients demonstrated subjective and objective improvement of their ocular myasthenic signs and symptoms.

4. Two patients showed improvement with therapy but were unable to tolerate the drugs, two patients neither improved nor tolerated the treatment and one tolerated the medications but showed little improvement.

5. A program of management of these patients is outlined.

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THE EFFECT OF ANERGEX ON IMMUNOLOGIC UVEITIS IN RABBITS*

A preliminary report

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There is a great deal of evidence indicating that the nonpurulent, endogenous types of uveitis are manifestations of allergy.[1] This type of allergic uveitis can be produced in experimental animals, thus permitting an investigator to study the effects of various types of therapy without subjecting patients to useless or possible harmful experimental procedures.[2]

Recently there have been reports indicating that a specially prepared extract of the Toxicodendron querifolium plant† has a beneficial effect in certain well-established allergic diseases.[3-7] Our study was undertaken to determine whether this extract might favorably influence the course of experimentally induced uveitis in rabbits.

Methods and Material

Twenty-three normal albino rabbits weighing approximately 2.0 kg. and of either sex were used. Commercially prepared 30-percent bovine albumin solution diluted 1:5 with isotonic saline was used as the antigen. The animals were sensitized by injections of 0.5

* From the Department of Ophthalmology, College of Medicine, Ohio State University.

† Anergex was supplied through the courtesy of Mulford Colloid Laboratories, Philadelphia 4, Pennsylvania.

TABLE 1

RECORD OF FINDINGS

Degree of Inflammation	Gross Appearance	Slitlamp Appearance
0	Appears normal	Appears normal
+	Minimal limbal flush	Absent or grade I flare Slight hyperemia of iris vessels Minimal exudate in anterior chamber
++	Moderate injection of iris vessels Moderate limbal flush Cornea clear	Grade II flare Few cells in anterior chamber
+++	Severe limbal flush Photophobia Severe iritis Sight corneal cloudiness	Grade III flare Many cells in the anterior chamber Punctate irregularity of the cornea Few synechia
++++	Severe fibrinous reaction in anterior chamber Fixed pupil Very severe limbal and iris hyperemia Synechia Moderate corneal cloudiness	Grade IV flare Corneal edema Marked fibrinous exudate in anterior chamber Synechia Fixed dilated pupil

ml. of the antigen intramuscularly and 0.5 ml. intravenously at three-day intervals until seven doses had been given by each route. The shock dose was given four days after the last sensitizing injections, and consisted of the injection of 0.02 ml. of the 1:5 dilution of albumin directly into the anterior chamber of the left eye of each rabbit. The right eye was not injected and served as a control.

The animals were divided into two groups and treated as follows:

Group I: Treated. On the day of the sixth sensitizing injection, treatment with the extract was begun in 13 of the rabbits. This consisted of a daily intramuscular injection of 0.25 ml. of the drug for two days, and 0.5 ml. daily for six additional days. (Since the maximum recommended clinical dose is 2 cc./day for a 70 kg. man, these rabbits received approximately four to eight times the usual human dose. This was tolerated with no toxic sumptoms.)

Group II: Controls. Ten animals were sensitized and shocked as described above but were not treated with the extract.

The eyes of all animals were observed daily both macroscopically and biomicroscopically. The ocular reactions were graded by an ophthalmologist who was unaware of the experimental disposition of the animals. Since the gross and the slitlamp appearance were found to be identical only one set of grades was used. The findings were recorded as ranging from 0 to ++++, as shown in Table 1. The uninjected right eyes showed no sympathetic effects throughout the duration of the experiment.

RESULTS

Following the intraocular shock dose of albumin, 20 of the 23 animals developed typical changes in the uvea—11 of the treated group and nine controls. (Since one of the control animals failed to show any ocular changes, the lack of uveitis in two treated animals cannot be considered as proof of the efficacy of Anergex and, therefore, these animals are eliminated from the tables and statistics.)

On the second day after the intraocular injection the treated rabbits showed almost as much reaction as did the controls, but by the third day there was impressive improve-

TABLE 2

OCULAR REACTIONS (O.S.) OF ANERGEX-TREATED AND CONTROL RABBITS TO ALBUMIN SHOCK

Anergex Treated	Days After Intraocular Shock Dose				
	2	3	4	5	6 to 8
1	+++	0	0	0	0
2	++++	+	0	0	0
3	++	+	0	0	0
4	+	0	0	0	0
5	++++	++++	+++	+++	+++
6	+++	+++	++	+	+
7	++++	+++	+	+	+
8	+	0	0	0	0
9	+	0	0	0	0
10	++	+	0	0	0
11	+++	0	0	0	0
Controls (Not Treated with Anergex)					
1	++++	++++	++	++	++
2	++	+	+	+	+
3	++++	+++	+++	+++	+++
4	++	0	0	0	0
5	++++	++++	++++	++++	+++
6	++++	++++	++++	++++	+++
7	++	+	+	0	0
8	++	+++	++	++	0
9	+++	+++	++	++	0

ment in the treated group. In five of the latter the uveitis had subsided completely; only one of the controls showed a similar improvement. On the fol'owing day three more of the treated animals were normal. These changes are shown in Table 2 and Chart 1.

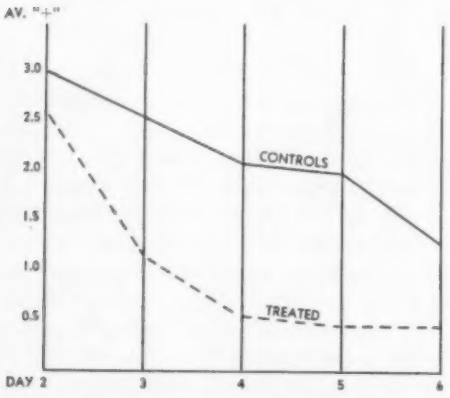

Chart 1 (Wachtel, Suie and Meissner). Average degree of uveitis in treated and control animals. Basis: Total "+" shown in table each day, divided by number showing uveitis originally.

DISCUSSION

As may be seen in Table 1, there seems to have been some degree of blocking action in the treated animals. It is difficult to evaluate the significance of this since the anti-allergic effect could not be demonstrated in all of the rabbits in Group I; three of 11 (27 percent) still had some inflammatory changes at the end of the period of observation. However, in the control group five of nine (56 percent) had not yet returned to normal.

Moreover it should be noted that the length of time required for the uveitis to subside in the treated animals was less than with the control group. Moderate to severe uveal reactions (++ to ++++) which were present in eight of the treated animals on the second postshock day had virtually subsided (0 to +) in five of them within the next 24 hours, and only three animals showed any ocular signs on the fourth day. Only one of the control animals showed complete clearing in this short time.

The site of action of this drug is still

undetermined. It has been shown that following its use there is a marked decrease in the eosinophils in the blood[8] and in nasal secretions of patients with allergic rhinitis.[3] Sensitivity as shown by skin testing is also definitely decreased after a course of injections. Experimentally, this substance appears to inhibit or prevent the release of histamine or histaminelike substances from mast cells; this may explain the anti-allergic blocking action which has been observed clinically.[9]

Summary

This extract appears to exert some degree of anti-inflammatory prophylactic action in immunologic uveitis in rabbits. The effect on naturally occurring uveitis in humans was not studied.

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PROGRESSIVE BILATERAL CHORIORETINITIS

Kodachrome record for eighteen years

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The results of an unusual opportunity to photograph the course of a severe bilateral chorioretinitis for 18 years, February 1942, to April 16, 1960, are here presented.

When first examined February 21, 1942, the patient, a 25-year-old unmarried woman, stated that on September 19, 1941, a dark, c'oudy spot appeared before her right eye. The vision grew worse and she consulted several doctors. After complete examinations, no cause was found for the condition. Various treatments had been given without avail.

The right eye vision was 20/200 unimproved by glasses. The pupil was regular and active, and reacted promptly to light and accommodation. The media were clear, the disc was distinct, and the margin sharp. The retinal vascular system showed no gross impairment except in the irregularly distributed, opaque, white scars and over the scattered pigmentations. On the nasal side there were several broad snail-like tracks of partial depigmentation with deposition of pigment on moth-eaten appearing margins, a chronic choroiditis.

The vision of the left eye with -0.25D. sph. $\bigcirc$ -0.5D. cyl. ax. 180° was 20/20+ and J1. The pupil was three mm., regular and active, and responded promptly to light and accommodation. The media were clear and the fundus negative. The normal disc was slightly oval with no central excavation. The veins and arteries were of normal size and distribution. There were a few posterior vitreous reflexes, one between the disc and

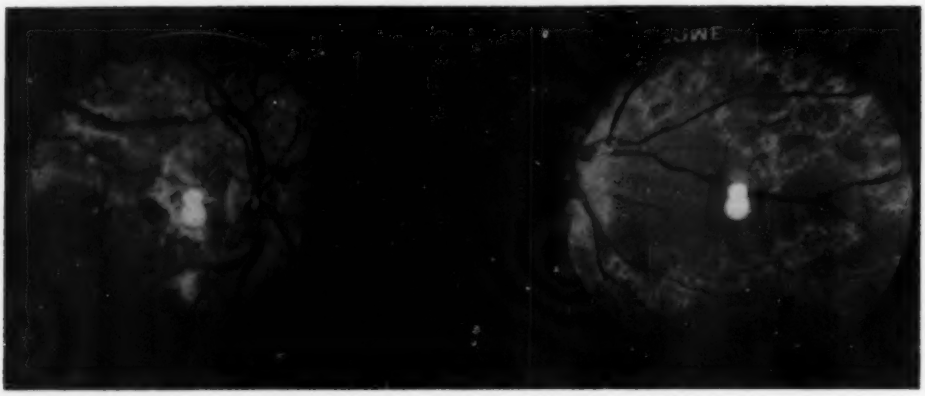

Fig. 1 (Bedell). (Left) Right eye, center, vision 20/200. (Right) Right eye, nasal side, February 21, 1942.

the sharply outlined macula with the typical prefoveal dot.

Correcting glasses were ordered and the patient was told that the sight of the right eye was permanently reduced.

She returned February 6, 1945, and reported that for two weeks the left eye had ached with a sensation as though she had looked at the sun. All tests including several of the blood were again repeated and her physician said that everything was normal. She had lost a little weight but had not been under any unusual physical or mental stress.

The left fundus showed alarming alterations. Surrounding the disc, close to it on the nasal side and about two disc diameters from the temporal margin were many confluent, elevated, yellowish, poorly defined choroidal exudates, so thick in places that the retinal vessels curved forward over them. In the macular region there was also a separate white plaque about one-fourth disc diameter in size. On the nasal side there were isolated, smaller areas and some confluent foci about the normal disc. The vision was 20/30.

Four days later there was a marked de-

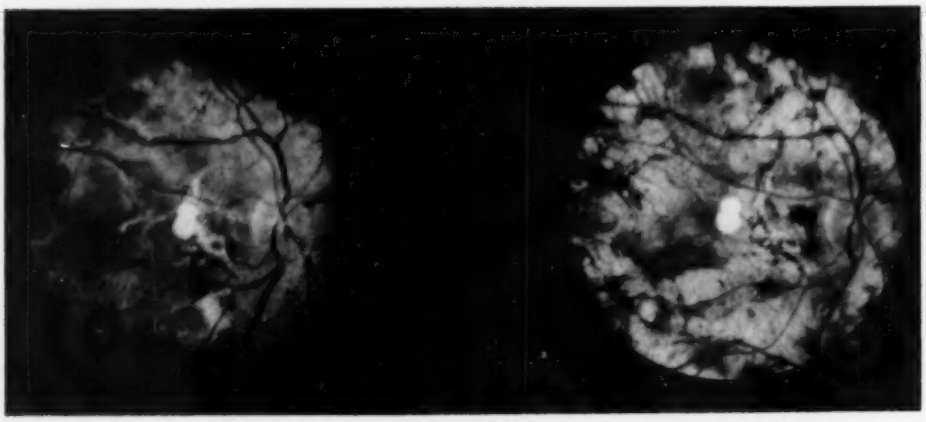

Fig. 2 (Bedell). (Left) Right eye, greater scarring February 2, 1945. (Right) Right eye, similar to left eye, April 16, 1960.

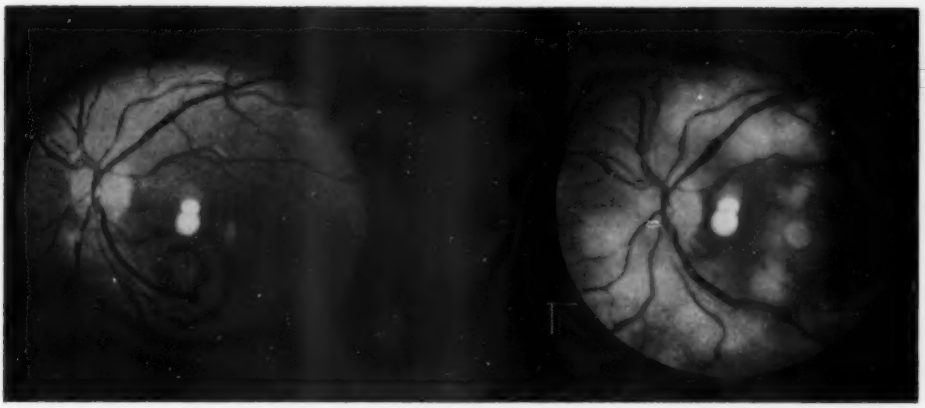

Fig. 3 (Bedell). (Left) Left eye, clear, normal fundus; gray clouds are vitreous reflexes, February 21, 1942. (Right) Left eye, confluent, yellow exudates; white central spot, February 6, 1945.

crease in the thickness of the exudates, the fundus was paler and the white spot, partially covered by exudate, was slightly larger with a gray border.

On February 19th, the dappled surface was much less uneven with more of the lighter colored areas and in the macular region a few ovoid, dark specks of beginning pigmentation. The white spot had disappeared.

By February 27th, the absorption of the exudate had so continued that the fundus surface was smoother, the individual patches were less defined and the distribution of the perimacular pigment greater.

On March 2nd, the absorption had progressed, the exudates were thinner and less distinct with more fluffy pigment.

On the thirteenth of that month, areas of complete choroidal absorption were evident as widely distributed even-margined, whitish foci. The largest were about the macula where the pigmented flecks had increased in density and size. The improvement continued

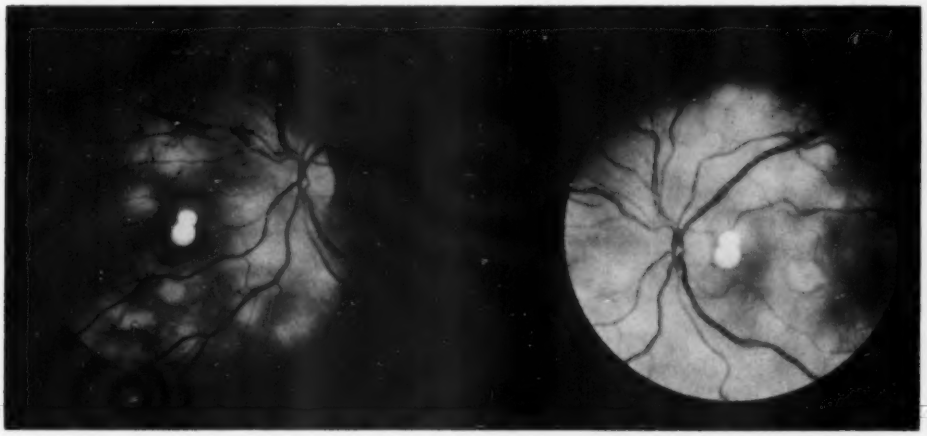

Fig. 4 (Bedell). (Left) Left eye, nasal side; widely dispersed exudates, February 6, 1945. (Right) Left eye, exudates thinner; white spot larger with a gray border, February 10, 1945.

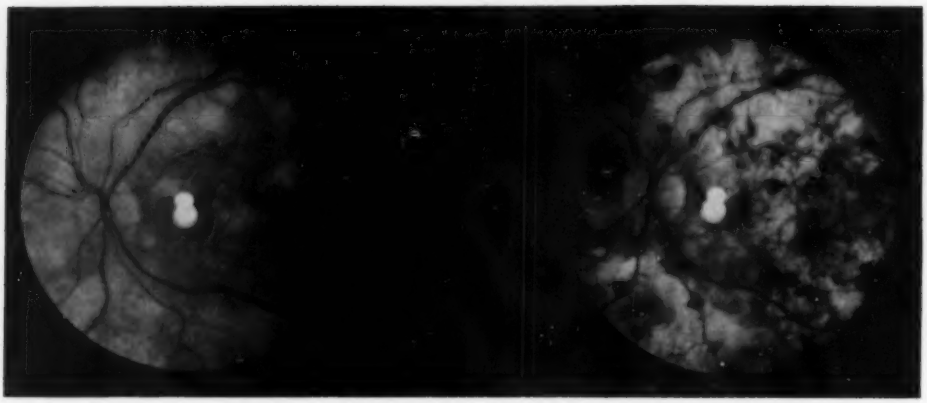

Fig. 5 (Bedell). (Left) Left eye, marked decrease in exudates with fluffy appearing pigment, March 2, 1945. (Right) Left eye, many dense pigment dposits over areas of complete or partial choroidal atrophy, February 4, 1951.

until by April 7th a few choroidal vessels were seen close to the macula on the scleral base.

The condition seemed to remain stationary so that the patient did not report again until March 11, 1947, when the appearance was that of a chronic, healing, disseminated chorioretinitis. The disc remained sharply outlined, but the retinal vessels, both veins and arteries, were smaller. The patches of complete choroid absorption were more numerous and bizarre in shape. The choroidal vessels were visible over larger areas and the irregular, widely dispersed pigment aggregations were denser.

After another three years, on April 23, 1950, the individual clumps of pigment were much thicker and more numerous, the sclera was more exposed and the choroidal vessels smaller. A year later, April 5, 1951, the scars were more evident and the pigmentary disturbance greater. By February 22, 1952, there was an increased paleness of the fundus, the result of the absorption of the

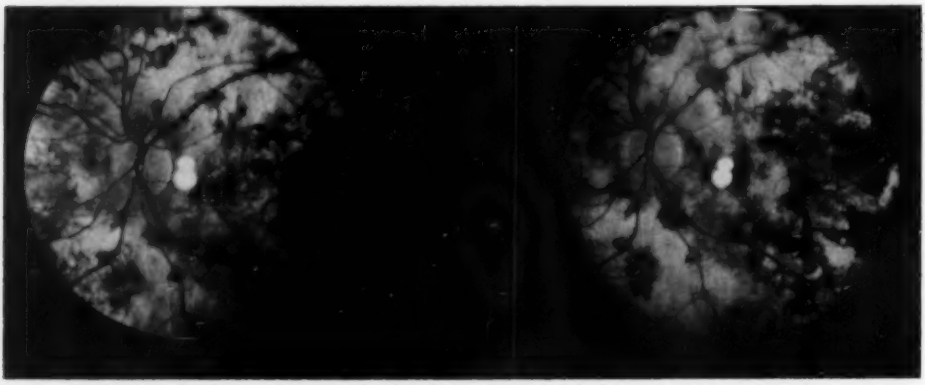

Fig. 6 (Bedell). (Left) Left eye, no acute choroidal exudates; disseminated pigmentations on, over and about the patches from which the choroid has disappeared, February 22, 1952. (Right) Left eye, disseminated chorioretinitis in the final stage of pigment clumps on the pale base over which it has migrated and proliferated; vision 20/200, with a —2.25D. sph., 20/20 in a small field, April 16, 1960.

choroid. The pigment accumulations were greater and more closely approached the disc. The retinal vessels were smaller, particularly in the lower half of the fundus.

Two years later, July 9, 1954, the pigment deposits were more numerous and larger in size. A year and a half later, the disc was normal pink, the arteries more attenuated, and the vision with −2.25D. sph. was 20/30. The pigmentations were very dense and dark and the functioning retinal areas were reduced in number with many discrete scotomas and marked field contraction.

The changes in the right eye were similar to those in the left as the degenerations increased in number and size and the scars and the pigment followed the established pattern. Only by careful scrutiny of the pictures can the minute changes be traced.

On December 20, 1957, the vision of the left eye with correction remained 20/30. But by March 14, 1960, the left eye vision was 20/200, with −2.25D.sph. = 20/20. The patient had more difficulty in reading because of the small field. The pigmentary disturbances were denser and the numerous scleral patches more prominent.

SUMMARY

In the beginning there was an old chorioretinitis in the right eye. The left eye was clear, but as time passed severe chorioretinitis developed which has been followed through periods of great exudations and absorptions to the permanent heavily pigmented deposits and atrophic choroid patches. No treatment seemed to stop the process. The patient has 20/20 vision in a small isolated field and has not developed physical signs of any body illness.

Examination shows how the individual and coalesced masses of exudate elevated the retina, how they subsided and the retina flattened, the choroid disappeared in places, and the pigment accumulated by migration and proliferation. It obviously would not be possible to demonstrate this complete cycle in any single enucleated eye and for that reason serial fundus photographs are of inestimable value to the clinician.

The Wassermann reaction was never positive although this fundus pattern has heretofore been considered syphilitic.

It is interesting to note that the patient's father has similar fundi.

The photographs record the location and appearance of the pigment deposits and the position of each exudate mass in a manner to prove the validity of the oft quoted "a picture is worth ten thousand words" and add evidence that clear photographs are part of a complete ophthalmoscopic, not funduscopic, examination.

344 State Street.

THE TREATMENT OF CONGENITAL CATARACTS BY NEEDLING

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INTRODUCTION

The various operations which have been advocated for the removal of congenital cataracts are in themselves evidence that a completely satisfactory technique is not yet known. The role of defender of the old reliable procedure is less glamorous and more difficult than the espousal of the new. Nevertheless, the ease, safety, and satisfactory results of the needling operation are so evident that it seems necessary to place a modern series in the record for comparison with modified procedures which have been reported in the last few years.

The needling operation as described here is one in which the anterior lens capsule is opened and the cortex is stirred up. Absorption is allowed for a minimum of 12 weeks after which time the operation may be repeated if necessary. Sometimes a discission of the posterior capsule is required at a later date. To supplant this, various protagonists have proposed the two-stage linear extraction, the one-stage linear extraction, aspiration of the lens, through-and-through discission, extracapsular extraction, and intracapsular extraction.

Attributes desirable in congenital cataract operations

In order to choose among the various surgical procedures, it is necessary to decide which features are most desirable. Among the items to be considered are safety, length of anesthesia, duration of hospitalization, applicability to various kinds of congenital cataracts, effectivity, incidence of early complications, incidence of late complications, and number of procedures required. The present study shows the needling operation to be pre-eminent in safety, to require only a brief anesthesia and subsequent hospitalization, and to be singularly free of complications. Furthermore, it is applicable to most kinds of cataracts in the young. Multiple operations are sometimes required.

Technique

With wide dilation of the pupil and the patient under general anesthesia, a Ziegler or Knapp knife-needle is entered under conjunctiva at the limbus into the anterior chamber. The anterior capsule is opened by two or more cuts. These are no longer than half the diameter of the lens face, and are placed so that the lens matter swells into the pupil and not behind the iris. The number of cuts and the amount of stirring up of the cortical material can be varied from case to case depending upon how much is to be accomplished. Care is taken that the posterior capsule is not opened. After withdrawal of the knife, atropine is instilled. Although a dressing is applied for 24 hours, the wound is sealed immediately after surgery and no protection is necessary.

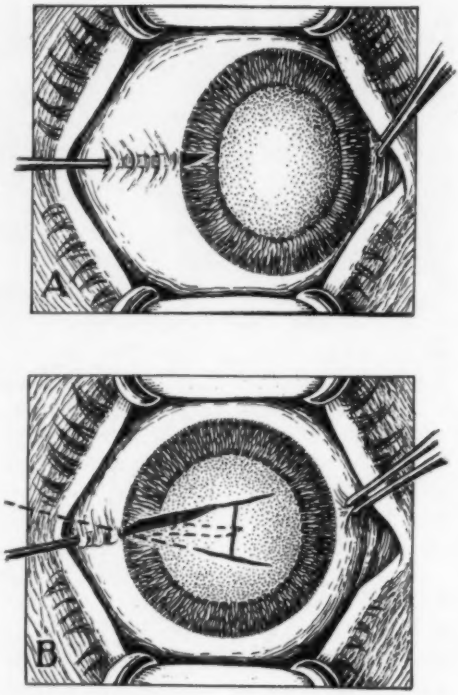

Fig. 1 (Jones). The technique of the needling operation. (a) The incision under conjunctiva at the limbus. (b) Incisions in the lens capsule.

So long as unabsorbed cortex is present additional needlings may be done at intervals no closer than 12 weeks apart. When the cortex is gone, then if a secondary membrane remains, it may be divided with a sharp Wheeler discission knife in either the Wheeler or the Ziegler manner, preferably the former. The Wheeler knife made by Grieshaber is especially good for this.

After care

Taking this entire group of cases as a whole, the average length of hospitalization was four days, with the shortest time being one day and the longest six days for the initial needling. The tendency in the past year,

however, has been toward shorter hospital stays, and the present average is two days. On either the first or second postoperative day the dressing is removed. Atropine ointment (one percent) in instilled once or twice daily so long as the amount of fluffy lens material increases or does not decrease. Usually within a week to 10 days the frequency of instillation can be reduced, but it is better to be on the side of caution.

Presentation of cases

Two groups of cases are presented, the first comprising 62 cases and 100 eyes. The second group of 31 patients and 32 eyes is separated from the first because it is made up of patients with persistent hyperplastic vitreous and contains peculiarities not shared by most congenital cataract patients.

The salient features are shown in the accompanying tables. Eight eyes had rubella cataracts. Seven were present in retrolental fibroplasia. Six had glaucoma and six had retinal dysplasia. Three were radiation cataracts, three were in microcephalics, and three were associated with Marfan's syndrome. Two were traumatic cataracts and two occurred in cerebral palsy patients. One patient had a complicated cataract (table 1).

The patients varied in age from one month to 26 years at the time of the first needling. The average was two years and eight months. Thirty-six cases were needled by the age of six months. An additional 16 cases were needled by the age of one year. Twenty-three had their first surgery between one year and five years. The remainder were needled after five years of age (table 2).

TABLE 1

Associated conditions

Condition	Number of Eyes
Rubella cataracts	8
Retrolental fibroplasia	7
Glaucoma	6
Retinal dysplasia	6
Radiation cataracts	3
Microcephaly	3
Marfan's syndrome	3
Traumatic cataracts	2
Cerebral palsy	2
Complicated cataract	1

TABLE 2

Age at which first needling was done

Age	Number of Eyes
1 to 6 mo.	36
6 mo. to 1 yr.	16
1 to 5 yr.	23
5 to 26 yr.	27

TABLE 3

Number of needlings required

Number of Needlings	Number of Eyes
1	77
2	20
3	2
4	1

Following the first needling, 20 of the 100 eyes required an additional needling. These were done at intervals varying from two months to six years with the average length of time being nine months. Two of these 20 eyes had a third needling at two to four months after the second, and a single eye had a fourth needling four months later (table 3).

Eighty of the 100 eyes required discissions of the secondary membrane at intervals after the first needling varying from one month to four years. The average interval was nine months. Nineteen additional discissions were done at various intervals due to reformation of the secondary membrane. There were no complications following the discissions. The cases have perhaps not been followed long enough to determine whether detached retinas may supervene in some instances.

The complications which occurred in the entire series consisted of two instances of glaucoma after the initial needling. One was treated by linear extraction two weeks after the needling and the other had a linear extraction and a cyclodialysis at the same inter-

val. It was thought that these complications resulted from a failure to maintain good dilatation of the pupil. One case in which iritis was present prior to the needling had a prophylactic linear extraction one week later and two cases which were to be away from medical supervision after the surgery also had prophylactic linear extractions.

Needlings in persistent hyperplastic vitreous cases

It seems worthwhile to consider these cases briefly because they illustrate the great safety of the needling operation. These eyes are small, with reduced anterior chamber volume. The lens is usually clear except for the disc-shaped opacity on the back surface. The needlings are done to eliminate cortical material so that a discission of the opacity can be done. The combination of clear cortical material and a small chamber would seem to predispose these eyes to the development of glaucoma after needling.

Thirty-two eyes were needled at an age varying from one month to three years, with the average six and one half months. One eye developed glaucoma and required a linear extraction. Only one quarter of the eyes required a second needling and none a third. Twenty-five eyes had discissions. One eye developed glaucoma after the discission.

In spite of the associated abnormalities in all of these eyes, 21 achieved a good pupillary opening.

Results

Largely due to the fact that these are the one hundred most recently done needlings, and the patients are consequently young, vision has been recorded on only 32 eyes. Seven had vision of 20/400 or poorer. Most of the patients were grouped in the range from 20/200 to 20/40, 21 being represented. Three had vision of 20/30 or better. Since vision is representative not only of the clarity of the media but also of the integrity of the other ocular structures, this cannot be regarded as an index to the success of the cataract removal (table 4).

TABLE 4

Visual results

Visual Acuity	Number of Eyes
Light perception	1
1/200	1
2/200	1
3/200	2
6/200	1
20/400	1
20/200	4
20/100	3
20/70	3
20/60	2
20/50	6
20/40	3
20/30	1
20/20	1
20/15	1

Disregarding vision, the criterion of a good result is taken to be a good pupillary opening. Seventy-eight of the 100 eyes had optically adequate openings. Fourteen eyes had remaining secondary membrane obstructing the pupil. Some of these 14 have not yet had a discission, and others will require a second discission. Four eyes which were complicated by retrolental fibroplasia went on to atrophy, as did one retinal dysplasia. One eye proved to have had an old detached retina.

Discussion

Unlike the admirable studies of Barkan,[1] Chandler,[2] Cordes,[3] Falls[4] and Owens and Hughes,[5] the scope of this study has been limited. No judgment has been made on what the criteria are for operation upon congenital cataracts, or when to do it, or upon how many eyes to do it. Rather, the intention has been to call attention to the sometimes forgotten virtues of the needling operation as a safe, effective and easy surgical procedure which is suitable for most congenital cataracts. It is predicated upon a total lack of co-operation on the part of the patient.

Operations which require a large opening

TABLE 5

REPORTS OF CONGENITAL CATARACT CASES

Patient	No. Cataracts	Associated Defects	Age Needled	Complications and Treatment	Interval of 2nd and 3rd Needlings	Interval of 1st Needling and Discission	Interval of 1st and 2nd Discission	Result	Comment
1. G. L.	1	RLF	1 yr. L			2 mo. L	3 yr. L	No clear pupil Adhesions	?RLF
2. J. M.	2	Rubella	6 wk. R 6 wk L			1 yr. R 1 yr. L		Black pupils	
3. B. S.	1	Rubella	2 mo. R		2 mo. R	4 yr. R		Black pupil	
4. J. S.	2	1 mo. premature	5 mo. R 5 mo. L		3 mo. R	6 mo. R 3 mo. L		Black pupils R.: 20/50 L.: 20/70	Nystagmus
5. L. B.	2	Glaucoma	3 mo. R 5 mo. L.		6 mo. R 4 mo. L	10 mo. R 8 mo. L	12 mo. R 10 mo. L	Black pupils	
6. J. C.	1		2½ yr. L					Faint secondary membrane to be discissed	
7. M. D.	2		11 mo. R 6 mo. L			17 mo. R 11 mo. L	5 yr. L	Black pupils	
8. D. R.	2	RLF	4½ yr. R 4 yr L	Glaucoma R: Linear R 2 wk later		3 mo. R 4 mo. L		Hemorrhage and atrophy O.U.	Due to RLF and PHV
9. S. F.	2		19 mo. R 19 mo. L			8 mo. R 8 mo. L		Black pupils	
10. A. F.	2		4 yr. L			11 yr. L		Black pupil	
11. D. L.	2	Premature	10 mo. R 9 mo. L			5 mo. R 6 mo. L	3 mo. R 3rd: 9 mo. R 4th: 3 yr. R	Secondary membrane R Black pupil L	
12. J. M.	2		6 yr. R 5½ yr. L		6 yr. R	15 mo. R 6 mo. L		Black pupils	
13. M. P.	2	Nystagmus	4 yr. R			4 mo. R		Black pupil	
14. S. R.	2		10 mo. R 1 yr. L			3 mo. R 4 mo. L		Black pupils	
15. G. S.	1		3 yr. R			5 mo. R		Pupil well dilated but soft lens matter	
16. S. L.	1		2 yr. R		5 mo. R			Black pupil Detached retina No light perception	Detached retina not due to surgery
17. R. G.	2	Congenital heart defect	15 mo. R 2 yr. L			13 mo. L	17 mo. L	Some secondary membrane R, good pupil Secondary membrane L	
18. R. H.	1	Retinoblastoma O.U.; Radiation cataract R; Enucleation L	8 yr. R			1 yr. R		Black pupil R	
19. R. K.	2		4 mo. R 6 mo. L			8 mo. R 7 mo. L		Black pupils	Nystagmoid movements
20. H. G.	2	Retinal dysplasia OU	2 mo. R 2 mo. L			2 mo. R 2 mo. L	7 mo. R 7 mo. L	Black pupils	No vision due to dysplasia
21. S. S.	2		10 yr. R, 1 wk. later: linear R (elective) 10 yr. L, 1 wk. later: linear L (elective)			7 yr. R		Black pupils	
22. M. T.	2		3 mo. R 5 mo. L			2 mo. R 7 mo. L	7 mo. R	Black pupils	Nystagmoid movements
23. R. W.	1	Traumatic cataract	16 yr. L			5 mo. L		Black pupil	
24. M. R.	2	Glaucoma	1 yr. R 2 yr. L			10 mo. L		Black pupils	
25. I. W.	1	Radiation cataract	1 yr. R			2 mo. R.		Black pupil	

(Continued on next page)

TABLE 5 (continued)

Patient	No. Cataracts	Associated Defects	Age Needled	Complications and Treatment	Interval of 2nd and 3rd Needlings	Interval of 1st Needling and Discission	Interval of 1st and 2nd Discission	Result	Comment
26. R. H.	2		1 mo. R 1 mo. L		3 mo. R 3 mo. L	7 mo. R 7 mo. L		Black pupils	
27. S. K.	2		20 mo. R 26 mo. L		4 mo. L	27 mo. R 22 mo. L	4 yr. R	Black pupils	
28. D. N.	2		22 yr. L		2 mo. L	6 mo. L	6 mo. L 3rd: 6 mo. L	Black pupil	
29. R. S.	2	RLF	7 yr. R 7 yr. L		4 mo. R 4 mo. L			Atrophic O.U. R. ciliary processes in coloboma above L. remains of hemorrhage	
30. K. W.	2		6 yr. R 7 yr. L		7 mo. L	1½ yr. R 1 yr. L		Black pupils	
31. J. B.	1		6 yr. L		18 mo. L			Secondary membrane to be done	
32. R. B.	1	Radiation	12 yr. R	Patient from out of town; Linear done—in interest of time		4 mo. R		Black pupil	
33. J. F.	2		7 yr. R 5 yr. L			10 mo. R 5 mo. L		Black pupil	
34. S. G.	1	Traumatic with leak	25 yr. R	Iritis before; Linear to minimize iritis				Black pupil	
35. E. H.	2		6 mo. R 6 mo. L		6 mo. R 7 mo. L			Black pupils	
36. N. J.	1	Rubella	1 yr. R		3 yr. R			Black pupil	
37. D. C.	2	Mother had cataracts	4 mo. R 4 mo. L			1 yr. R 1 yr. L		Black pupils	
38. P. M.	2		6 mo. R 6 mo. L			4 mo. L		Black pupils	
39. A. M.	2		5 mo. R 5 mo. L		3 mo. R 3rd: 4 mo. R 4th: 4 mo. R	13 mo. R 3 mo. L		Black pupils	
40. J. W.	1	Complicated cataract	15 yr. L					Dense secondary membrane	Not pursued due to poor vision
41. M. Z.	2		5 yr. R 4 yr. L	Glaucoma, two weeks later: Linear; cyclodialysis		11 mo. R 5 mo. L		Black pupils	
42. K. A.	2	Retinal dysplasia	10 mo. R			3 mo. R		Atrophy: not from surgery	L eye also lost; no surgery
43. T. A.	2	Retinal dysplasia	2 yr. R 2½ yr. L		2 mo. R 3rd: 2 mo. R 3 mo. L	6 mo. R 9 mo. L		Black pupils	
44. J. B.	2	Congenital glaucoma	2½ yr. R 2½ yr. L			To be done		Awaiting glaucoma control	
45. P. L.	1	Microcephaly	4 mo. L		2 mo. L	5 mo. L		More to be done	
46. E. W.	2	Microcephaly	2½ mo. R 2½ mo. L		9 mo. R	4 mo. R 9 mo. L	4 mo. L	Secondary membrane, O.U.	To be done again
47. R. S.	2	Heart defect Brain damage	10 mo. R 10 wk L			4 mo. R 9 mo. L		Black pupils	Slight Nystagmus
48. M. S.	2	Permaturity	8 yr. L			21 da. L		Black pupil	Inadequate follow-up
49. S. R.	1		4 mo. R			5 mo. R		Black pupil	
50. L. A.	2	Rubella	2 mo. R 6 mo. L			6 mo. R 6 mo. L	12 mo. R	Black pupil	

TABLE 5 (continued)

Patient	No. Cataracts	Associated Defects	Age Needled	Complications and Treatment	Interval of 2nd and 3rd Needlings	Interval of 1st Needling and Discission	Interval of 1st and 2nd Discission	Result	Comment
51. R. B.	2	Prematurity	7 mo. R 7 mo. L			6 mo. R 6 mo. L	12 mo. R	Black pupils	
52. G. L.	2	Rubella	5 mo. R 5 mo. L			1 yr. R 1 yr. L		Black pupils	
53. D. H.	2	Mother had cataracts	1 yr. R 1 yr. L					Black pupils	
54. E. H.	2	Rubella	8 mo. R 8 mo. L			5 mo. R 5 mo. L		Black pupils	
55. P. P.	1		6 mo. L			6 mo. L		Black pupil	
56. N. S.	2	Marfans	7 yr. L					Secondary membrane	To be done
57. J. M.	2		2 mo. R 8 mo. L			6 mo. R 4 mo. L	11 mo. L 3rd: 20 mo. L	Black pupils Slight iris bombe L	
58. F. G.	1		3 yr. R			3 mo. R		Black pupil	
59. F. S.	1	RLF	15 mo. R 6 mo. L			6 mo. R 5 mo. L	7 mo. L	Black pupil	
60. S. S.	2	Cerebral palsy	4 yr. R 5 yr. L					Black pupils	
61. F. D.	2	Marfans	7½ yr. R		10 mo. R 3rd: 3 mo. R	1 yr. 10 mo. R			
62. W. F.	2		7 yr. R 6 yr. L			1 yr. R 10 mo. L			

in the globe make the convalescent period more precarious because of the necessity to keep a dressing on the eye and to keep the child's hands out of it. Procedures which introduce irrigating solutions increase the chance of intraocular infections. Through-and-through discissions traumatize the vitreous body simultaneously with the opening of the lens. Intracapsular extractions now made possible with zonulolytic enzymes seem to carry with them increased risk of vitreous loss and later complications for the eye.

Since the needling procedure is thought adequate for all types of congenital cataracts, no particular attention has been paid to the various kinds and degrees of opacity. The only cases which might require a preliminary procedure are those with a small pupil which cannot be dilated.

No attempt has been made to correlate the results obtained and the complications encountered with the age at which surgery was done. The number of needlings required can be controlled to some extent by the amount of stirring up of the lens cortex. Greater mixing of cortex and aqueous causes greater absorption. By the same token, it also causes greater swelling, and perhaps some slight increased risk of glaucoma.

Turning now to the question of safety, in this series of cases no eyes were lost as the result of surgery and only two eyes developed glaucoma. No detachments have been noted to date. It is not claimed that promiscuous or careless needling operations are free of the risk of glaucoma. If too wide an opening is made in the lens capsule or if the pupil is not kept well dilated, then cortical material may get behind the iris and force it forward causing a blockage of the angle. For this reason care should be taken that this does not occur both by virtue of making the original opening of the capsule small and also by assiduous attention to prolonged wide pupillary dilatation. That no co-operation on the part of the patient is necessary in the convalescent period may also be considered a safety factor of some moment.

TABLE 6

CASE REPORTS OF PATIENTS WITH PERSISTENCE AND HYPERPLASIA OF THE PRIMARY VITREOUS

Patient	No. Cataracts	Associated Defects	Age Needled	Complications and Treatment	Interval of 2nd and 3rd Needlings	Interval of 1st Needling and Discission	Interval of 1st and 2nd Discission	Result	Comment
1. M. L.	1	PHV R	5 mo. R			14 mo. R		Atrophic R due to PHV	
2. L. L.	1	PHV L	3 mo. L		6 mo. L	10 mo. L		Black pupil	
3. W. R.	1	PHV L	1 yr. L		3 mo. L	7 mo. L	6 mo. L	Enucleation L for glaucoma	
4. J. R.	1	PHV L	2 mo. L			3 mo. L	2 mo. L	Thick opaque tissue L	
5. W. C.	1	PHV	7 wk. R 7 wk. L	Glaucoma linear 4 mo.		4 mo. R 4 mo. L		Black pupil	
6. D. C.	1	PHV	1 mo.		4 mo.	9 mo.		Some secondary membrane	
7. L. D.	1	PHV	3 yr.		3 mo.			Black pupil	Detached retina due to PHV
8. J. D.	1	PHV	1½ yr.		6 yr. 2nd, 15 mo. 3rd, 11 mo.	6 yr. 2nd, 15 mo. 3rd, 11 mo.		Black pupil	Part of secondary membrane behind lens
9. J. H.	2	PHV OU Hemorrhage and 2 glaucoma cyclodiathermies	5 mo. R 5 mo. L			5 mo. R 5 mo. L		Complicated by hemorrhage from PHV	
10. K. S.	1	PHV	4 mo.					Eye soft, detached retina, hemorrhage	
11. P. G.	1	PHV	2 mo. L		4 mo. L	7 mo. L		Hyphema and glaucoma, irrigation and iridectomy	Enucleation of L 2 yr. after needling
12. R. L.	1	PHV L	No needling			2 yr. L	3 mo.	Black pupil	
13. R. G.	1	PHV R	2 mo. R			7 mo.	2 yr.	Black pupil	
14. D. G.	1	PHV R	2 mo. R	2 mo. PO Iris bombe, Peripheral iridectomy		Central iridotomy 4 yr. after needling		Black pupil	
15. J. G.	1	PHV L	9 mo. L			8 mo. L	2 mo. L	Black pupil	
16. E. G.	1	PHV R	4 mo. R			3 mo. R		Black pupil	
17. I. G.	1	PHV R	4 mo. R			4 mo. R		Small pupil	
18. D. H.	1	PHV R	1 yr. R					Secondary membrane	To be done
19. R. M.	1	PHV L	4 mo. L		2 mo. L	4 mo. L	4 mo. L 3rd, 4 mo. L	Black pupil	Poor vision, PHV
20. K. S.	1	PHV R	3 mo. R		1 mo. R	4 mo. R		Glaucoma due to PHV	Cyclodiathermy
21. J. S.	1	PHV R	1 yr. R			7 mo. R		Black pupil	
22. P. V.	1	PHV L	8 mo. L			7 mo. L		Black pupil	
23. D. C.	1	PHV	8 wk.			2 mo.		No vision, due to PHV	
24. J. G.	1	PHV L	2 wk. L			5 mo. L		Hammock pupil L	
25. A. H.	1	PHV L	4 mo. L		9 mo. L				
26. L. N.	1	PHV R	3 mo. R			6 mo. R		Black pupil	
27. L. C.	1	PHV	1½ yr.					Black pupil	
28. D. H.	1	PHV L	1 yr. L			5 mo. L			
29. E. S.	1	PHV R	8 mo. R	Iris bombe, iridectomy		3 mo. R	3 yr. R and muscle surgery	No pupil	
30. W. W.	1	PHV L	2 mo. L			3 mo. R	7 mo. R	Black pupil	

Although much has been made of the risk of multiple anesthetizations sometimes required in using needling operations, this is perhaps mitigated by the fact that the anesthesia may be on a superficial plane and of only the briefest duration. The entire surgical procedure usually takes less than one minute. Likewise, the hospitalization after surgery is not so much for the purpose of convalescence as it is to give the surgeon a chance for close observation of the patient for a day or two. There seems no surgical reason why the patient could not leave the hospital immediately after the surgery.

Summary

1. Two groups of congenital cataracts treated by needlings are presented. The first group comprises 100 eyes and a variety of kinds of congenital cataracts. The second group comprises 32 eyes all being afflicted with persistence and hyperplasia of the primary vitreous.

2. In the larger group no eyes were lost and only two eyes developed glaucoma after the needling operation. The smaller group which was included to illustrate the safety of the needling procedure in potentially more difficult cases also suffered no loss of eyes as a result of surgery and only one eye developed glaucoma.

3. These cases are offered as being exceptionally free of undesirable sequelae of the cataract surgery.

4. The advantages of the needling operation for congenital cataracts are outlined for comparison with the advantages and disadvantages of other commonly employed procedures.

73 East 71st Street (21).

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LINEAR EXTRACTION IN CONGENITAL CATARACT SURGERY*

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Discission, in one form or another, is the most popular and widely used operation for congenital cataract surgery at this time. While it has been said that linear extraction and removal of the anterior capsule and cortex in one procedure is not indicated, there is enough evidence to the contrary to make this statement debatable.

First of all, it seems well to define linear extraction. DeSchweinitz[1] says that linear extraction is indicated in very soft cataracts or in those that have a very small nucleus. The incision is made one mm. inside the limbus and five mm. wide; the capsule is lacerated with a cystotome and the lens material is expressed. This is known as a simple linear extraction.

My own method[2] of doing this operation, which is a modified Otto Barkan operation,[3] is as follows:

After the routine preoperative preparation and anesthesia, two drops of epinephrine hydrochloride (1:1,000) are injected at the

* From the Department of Ophthalmology, University of California Medial Center at San Francisco, and the Francis I. Proctor Foundation for Research in Ophthalmology. Presented before the American Ophthalmological Society, May 16, 1960.

limbus above, the open part of the needle being directed toward the limbus. After five or 10 minutes, the pupil is widely dilated, especially at the site of the impending incision, and a suture is placed in the superior rectus. The dilation of the pupil resulting, as it does, from the contraction of the sympathetic fibers, persists when the anterior chamber is opened, and this keeps the iris out of the wound.

Prior to the incision a stab wound is made into the anterior chamber below and temporally to facilitate the injection of air after the completion of the operation. As an aid in locating the opening, the knife-needle is wiped on a piece of wet filter paper that has previously been impregnated with fluorescein, according to the method described by Kimura,[4] and the fluorescein is allowed to dry on the knife before the stab wound is made. This leaves a green stain along the course of the stab wound, which persists during the entire operation.

A keratome incision is made 1.5 to 2.0 mm. inside the limbus and parallel to the iris surface, to produce a valvelike opening. A large capsulotomy is now performed with Fuchs' capsule forceps. It is important to remember that the capsule forceps should be used only once, because of the danger of biting through the posterior capsule into the vitreous. The lens substance is now expressed and the anterior chamber washed out with isotonic sodium chloride solution.

With a small Luer syringe and a 28-gauge needle, air is injected through the previously made puncture wound. If the tip of the needle is dulled a little, it has less tendency to catch in the course of the puncture wound. The air remains in the anterior chamber for several days and prevents the iris from coming into contact with the keratome wound in the cornea, and thus prevents the formation of anterior synechias. The long-continued use of atropine after operation is important.

Chandler[5] and others prefer to make the incision at the limbus under a conjunctival flap with a suture in the wound. Simple extraction is definitely contraindicated in those cases where the pupil cannot be easily and widely dilated before surgery. In addition, it should not be used in those instances where there is a membraneous or other thin type of cataract because of the danger of vitreous loss after the use of capsule forceps.

Some surgeons prefer a combination of a discission and a linear extraction. In this procedure, a fairly extensive discission of the anterior capsule is performed. The eye is then kept under observation for several days, until the lens material is sufficiently disintegrated to permit easy removal by linear extraction, which can be done by the Barkan technique, or through a limbal incision. For reasons already given, no attempt should be made to remove pieces of the anterior capsule, because of the danger of vitreous loss. When a limbal incision is made, a peripheral iridectomy is always indicated. The usual postoperative regimen is followed.

The results of this operation are among the best. It has only two disadvantages: (1) Two operations are required, and this is a serious objection to the parents; (2) there is danger of acute glaucoma, especially in patients of the adolescent age group, which would necessitate an emergency operation.

In those cases where the pupil will not dilate easily and widely preoperatively or in which surgery on the other eye has shown that it is impossible to keep the pupil well dilated postoperatively, a full iridectomy should be done. Where there is no dilation, in addition to the iridectomy, an iridotomy of the sphincter should be done below. This will prevent the pupil from drawing up as it may do if only an iridectomy is performed. The recent tendency has been to do a full iridectomy in all cases of congenital cataract surgery. Rubella cataract certainly falls into this category.

The procedure is as follows:

A five-mm. keratome incision is made at the limbus. The iris is then grasped about midway between its root and the pupil, in as small a bite as possible. The iris is pulled out,

and the iridectomy is done with the scissors at right angles to the incision. The capsulotomy is now performed and the extraction completed in the usual manner. Atropine is administered after operation.

The importance of the use of atropine or scopolamine after any type of congenital cataract surgery, for as long as two months after the eye seems to have cleared entirely, cannot be overemphasized. If mydriatics are discontinued before all the cortex is absorbed, there is usually an occlusion of the pupil or posterior synechia formation.

It is impossible to put too much stress on the importance of iridectomy in the surgery of congenital cataracts. Horay[6] felt that the small, bound-down pupil was probably the chief cause of postoperative complications and therefore advised that iridectomy be done in every case. That iridectomy is indicated in those eyes in which the pupil cannot be easily dilated was also emphasized by von Graefe many years ago.[5] It is well known that this failure of the pupil to dilate is common in congenital cataracts and is often the cause of occlusion of the pupil from the formation of a thick membrane composed of capsule and lens remnants, or of a complicated membrane due to inflammation, organized exudate, or hemorrhage. An iridectomy cannot be done in a simple discission.

Complications of Linear Extraction

There are two complications that are limited to the modified Barkan type of linear extraction described above:

1. *Delayed restoration of the anterior chamber, with formation of peripheral anterior synechias.* This complication can be prevented if the incision is made at the proper angle, so that the opening is valvelike, thus assuring rapid closure and healing of the operative wound. Furthermore, the injection of air into the anterior chamber restores it before the patient leaves the table.

2. *Anterior synechias with the pupil drawn up.* This complication can usually be avoided if the technique outlined above is carried out in detail. The injection of air is an especially important factor. Care should be taken not to inject too much air, however, as glaucoma may be induced and may persist as long as 48 hours.

In addition to these there are certain complications that may occur in any type of linear extraction:

3. *Occlusion of the pupil.* This complication may occur in cases in which the pupil will not dilate well or in which the postoperative use of mydriatics has been discontinued too soon. It rarely occurs in cases in which an iridectomy has been done. The necessity of long-continued use of mydriatics, even in cases in which an iridectomy has been done, cannot be stressed too much.

4. *Membrane formation.* This complication may result from an inadequate opening in the capsule with associated iritis. It may be associated not only with linear extraction but with any of the other types of congenital cataract surgery. In doing the capsulotomy, it is important to make a large opening, although it must be remembered that use of the Fuchs' capsule forceps must be limited to one attempt. If the forceps are reintroduced, a piece of the posterior capsule which has been displaced forward will in all probability be grasped and vitreous will be lost. As already stated, another cause of membrane formation is an inadequately dilated pupil associated with iritis.

5. *Vitreous loss.* This occurs infrequently if the proper precautions are taken. The lens material should be milked out with a gentle stroking motion, caution being exercised not to use too much pressure. After the cortex is milked out with a spoon, the anterior chamber should be washed out with saline solution. All cortex that can be washed out will come out quickly, so that prolonged lavage not only is unnecessary but may result in loss of vitreous. For the same reason, no attempt should be made with forceps to remove cortex that has not washed out; the risk of loss of vitreous is too great. An impor-

tant factor in avoiding loss of vitreous is in knowing when to stop. Cortex does absorb; so it is the part of wisdom not to do too much.

6. *Glaucoma.* Very rapid swelling of the cortical fibers, with blocking of the angle of the anterior chamber, may induce glaucoma. When this complication occurs within the first four days, opening the wound with an iris repositor and washing out the cortex controls the glaucoma. If a Barkan type of linear extraction is done, epinephrine should be injected at the limbus at the time of operation, and air should be injected at the completion of the operation. This complication has occurred three times in my personal experience.

An inadequate capsule opening, resulting in acute swelling of the lens, may also produce glaucoma. In this event, a second capsulotomy and lavage of the cortex is remedial.

7. *Expulsive hemorrhage.* There is another possible complication of linear extraction that has not been generally recognized, namely, expulsive hemorrhage on the operating table. In a series of 112 eyes enucleated after failure of congenital cataract surgery were four cases of expulsive hemorrhage, three occurring on the table and one taking place two days after surgery. The age of these patients varied between four months and 21 years.

Review of literature

An attempt to evaluate the different procedures used in the surgery of congenital cataracts based on a review of the literature brought out some interesting findings.[7] The usual standard of evaluation is the resultant visual acuity. Here it must be remembered that most of the authorities agree that in approximately 50 percent of the cases of congenital cataracts associated ocular defects are present. Owens and Hughes[8] found these congenital defects in 56 percent of their series. The children in whom early operation is indicated have a higher percentage of these defects and this, probably, is the principal factor in the poorer visual results in children operated upon before they are two years of age. Thus it can be said that the relatively poor visual results after congenital cataract surgery are attributable at least in part to the ocular defects already mentioned.

There are several series of cases in the literature that are noteworthy. Falls[9] reported the results in a series of 132 cases, in which 71 percent of the eyes were treated by discission and 22 percent by discission combined with linear extraction. Of the patients treated by discission alone, 27 percent achieved a vision of 6/12 or better, and of those treated by discission and linear extraction combined, 55 percent secured a vision of 6/12 or better, indicating that the latter procedure produces the best visual results.

Horay[6] reported his results in 282 operations. Equal numbers of his patients were subjected to discission, linear extraction, and combined linear extraction and discission. The age of the patient played no part in the decision as to which type of operation was to be used. The best results were obtained with linear extraction, and the poorest, with discission. Horay expressed the belief that the opinion that operation should not be done during the first year was unsound, as his results were equally satisfactory when the operation was performed during the first year and when it was performed later. He attributed many of the failures of operation during the first year to other congenital anomalies. His choice of procedure was the combined iridectomy and extraction performed at one sitting, irrespective of the age of the child.

Owens and Hughes,[8] in a review of 231 eyes operated on at the Wilmer Ophthalmological Institute, found that linear extraction, or discission followed by linear extraction, produced better results than simple discission. They found, further, that the number of secondary operations necessary to clear the pupillary space was higher after

simple discission than after linear extraction or after discission with subsequent extraction. They also made the interesting observation that complications occur with essentially the same frequency after extraction of senile cataract as after extraction of congenital cataract. The poorer visual results from congenital cataract surgery they attributed to gross or obscure associated ocular defects.

Bagley,[10] in an attempt to evaluate the various surgical procedures for congenital cataract, studied the results in 87 eyes operated on at the Wilmer Ophthalmological Institute between October, 1943, and November, 1947. He found that the results following single or repeated needlings were significantly poorer than the results following needling with subsequent lavage or following linear extraction. The final visual result following linear extraction was satistically better than the result following needling and subsequent lavage.

These rather extensive series of cases seem to present conclusive evidence that in the properly chosen patient linear extraction produces better visual results than do single or especially multiple needlings.

Chandler[5] stated his choice of a procedure in bilateral complete cataract in infancy to be complete iridectomy with linear extraction.

Retinal detachment

The occurrence of late detachment of the retina following congenital cataract surgery warrants special consideration:

The association of detachment with aphakia is not always apparent, however, since 20 years or more may elapse before the retina detaches and by that time the patient is likely to be under the care of another ophthalmologist. Foster Moore[11] felt that removal of the lens, whether by extraction or discission, predisposed to development of detachment of the retina. Doggart[13] went so far as to state that enough evidence had accumulated to suggest that an eye deprived of its lens had at least one chance in four of sustaining retinal detachment within two or three decades.

Denig,[12] Barkan,[3] Cordes,[7] Doggart,[13] and others have all maintained that retinal detachment is most apt to be a late complication.

Shapland,[14] in examining 22 patients reporting to Moorfields with retinal detachment after congenital cataract surgery, found that 40 eyes had been operated upon by multiple discissions. At an average of 24.6 years after surgery 33 eyes, or 82.5 percent, had developed retinal detachment.

Most authorities agree that the more the vitreous is disturbed, the greater the danger of retinal detachment as a late complication. Vitreous loss at the time of operation, with vitreous incarcerated in the wound following linear extraction, is apt to result in cicatrization, later in contraction, and eventually in detachment through traction.[14] Chandler,[5] Barkan,[3] Horay,[6] Knapp,[15] and others all agree that late detachment occurs much more frequently after needling, especially repeated needling, than after linear extraction. Foster Moore[11] found that seven percent of all eyes operated upon for congenital cataract by needling developed retinal detachment.

It is interesting that the pathology laboratory findings seem to follow the clinical observations rather closely as seen in eyes enucleated after failure of congenital cataract surgery.[16] These eyes, for the most part, were obtained from the Armed Forces Institute of Pathology so that they represent a fair cross section of the country. In a more recent group of 112 eyes there were 54 eyes with retinal detachment; of these 21 or 40 percent, occurred between 10 and 33 years after surgery. In this group 16 (76.1 percent) developed a late retinal detachment after multiple needling; in two (9.2 percent) it followed linear extraction; in two it occurred after unknown type of surgery and in one instance it followed single needling. The average time between the last surgery and the detachment was 20.1 years, corresponding rather closely to Shapland's clinical findings[14] of 24.6 years. These figures seem statistically significant. The underlying causes of the de-

tachment in these cases were discussed in a recent paper.[17]

Another rather significant finding in this group of late detachments was the occurrence of late spontaneous intraocular hemorrhage. It occurred in eight of the 21 cases at intervals of between 10 and 25 years after the last surgery. No direct cause could be determined. It is noteworthy, however, that in seven of the eight cases multiple discissions had been done.

Summary

Personal experience and a review of the literature would seem to warrant the conclusion that in the properly chosen case linear extraction is the operation of choice as far as the visual result is concerned.

The importance of iridectomy in those eyes in which the pupil cannot be dilated easily cannot be emphasized too much.

Multiple discissions seem to give the poorest visual results and appear to carry the greatest risk of late detachment of the retina or late spontaneous intraocular hemorrhage.

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A SAFE APPROACH IN SURGERY OF CONGENITAL CATARACTS*

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Cataract surgery in children is considerably more difficult than in adults. First, the presence of vitreous-lens adhesions, which unfortunately are not dissolved by alpha chymotrypsin,[1] makes it extremely difficult to deliver the lens without losing vitreous. Second, although easily lyzed by alpha chymotrypsin, the zonules in children are relatively stronger than in adults. Third, postoperative care demands full attention, as the chances are great that a child may injure his own eyes.

In view of these difficulties, many ophthalmic surgeons have confined themselves to multiple discission† as a means of restoring sight in children born with cataracts. Doggart[3] declares that discission is the operation of choice in infants. But this procedure is not without danger. When the lens is cut with a needle-knife, the cortical material and often some particles of the relatively hard nucleus, if present, escape into the anterior chamber. This may lead to glaucoma, due to swelling of the disturbed lens substance and blockage of the angle by lens debris. Moreover, there is not infrequently a resulting iritis or iridocyclitis, as shown by photophobia and redness of the operated eye. Although in a few cases, the absorption of the lens may be remarkable and, on the average, just two or three more discissions need be done, Wiener and Alvin[4] stated that, in some instances as many as 17 or 18 procedures have been required to create a clear pupillary space. No wonder Horay[5] reported poorest results were obtained with discission, compared to linear extraction‡ and other types of cataract extraction in children!

Owens and Hughes[6] also came to the same conclusion as Horay: simple discission yielded poorer visual results than linear extraction or discission and linear extraction. In addition, they found out that the number of secondary operations necessary to clear the pupillary space was higher after simple discission than after linear extraction or discission with subsequent linear extraction. The findings of Bagley[7] corroborated those of Owens and Hughes: the results following single or repeated needlings were significantly poorer than the results following either a needling with subsequent lavage or techniques for linear extraction. Callahan[8] encountered heart-breaking complications when he performed a discission on a three-year-old boy.

Multiple discission tends to increase the chances of detachment of the retina. Shapland[9] observed that, after an average interval of 24 years, 33 of a total 40 cases in which needlings had been performed developed retinal detachment. Chandler[10] associated this complication with disturbance of the vitreous. There is no doubt that the retinal detachment is brought about by contraction of the vitreous strands in those cases in which the needle-knife had sliced the anterior vitreous face and in those in which the vitreous was actually spilled through the needle-knife opening or even in those in which the vitreous had only become dislodged into the anterior chamber.

Because of the aforementioned findings,

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† The term *discission*, as used in this article, may mean one of the following: (1) the breaking up of the lens cortex and nucleus by a needle-knife, (2) capsulotomy or splitting the capsule, (3) capsulectomy or cutting out a piece of the capsule, or (4) through-and-through cutting of the lens as advocated by Ziegler[2] in 1921.

‡ The term *linear extraction* here signifies a technique for extracting a cataract by means of a keratome section through which opaque lens matter is expressed into a long, shallow spoon or curette; the residue in the anterior chamber is washed out with an irrigator. In cases of immature cataract, this procedure is usually made easier by performing a discission 48 hours prior to it.

as well as those of his, Cordes[11] concluded that it would appear that linear extraction done in one sitting is the operation of choice in the average soft cataract.

But linear extraction is not without danger when done on a young child, even with the best of postoperative sedation. Complications such as infection, iris prolapse, gaping of wound, inadequate or irregular pupillary opening, may occur. Moreover, there is the necessity of doing a discission or a number of discissions to clear the pupillary opening. Because it is difficult to extract all the lens matter by this technique, Stallard[12] suggested that linear extraction is an unsuitable operation for children.

Requirements for an ideal procedure

What then is the ideal procedure for congenital cataract surgery? Cordes[11] enumerates the following points:

1. A single procedure will provide for removal of the major portion of the lens so that the rest can absorb.
2. There will be no interference with the pupil and a minimum danger of iris incarceration or adherence to the wound.
3. There will be no interference with the posterior capsule and vitreous.
4. The danger of glaucoma will be minimized.

I wish to emphasize the following points:

1. The operation will produce as little trauma and postoperative reaction as possible.
2. It will be simple to do.
3. It will create an adequate pupillary opening without producing such complications as glaucoma, detached retina, phthisis bulbi, iris incarceration or adherence to wound, and so forth.

Classification of congenital cataracts

Before discussing the surgical management, it would be well to present an arbitrary classification of congenital cataracts that would be practical for the surgeon's purpose (fig. 1). Congenital cataracts may be simply classified according to how soft or how "liquidlike" they appear:

Type I. Cortex and nucleus clear. Opacities limited to posterior capsule and/or subcapsular area.

Type II. Cortex and nucleus clear. Opacities limited to anterior capsule and/or subcapsular area.

Type III. Opacities limited to nucleus only.

Type IV. Zonular distribution of opacities.

Type V. Total cataract.

Type VI. Membranous cataract.

Type VII. Mixed type. Axial fusiform (anterior and posterior polar cataracts united by threadlike opacities). Included in this group are the other morphological types: coralliform, spear, floriform, spirochete, and so forth.

Congenital cataract workup

The child's parents should be asked the following questions:

1. When did you first notice that your child could not see?
2. Any other members of the family with congenital cataracts?
3. Is there a history of prenatal or postnatal eye injury?
4. Did the child's mother ever contract rubella in the first trimester of pregnancy? Any other febrile conditions or drug intoxication during pregnancy?
5. Any previous eye examination or eye surgery?

To determine adequately the type and extent of cataract, the child's pupils should be dilated as widely as possible, using 10-percent Neosynephrine and Cyclogyl (one percent). Then direct ophthalmoscopy with 8.0 to 12 diopter lenses is done, followed by careful slitlamp examination. In my experience, children even as young as three years of age may be talked into this, if the ophthalmologist is patient in his approach. When this is not possible, however, arrangements should be made for a Haag-Streit slitlamp to be used in the operating room immediately before surgery, while the child is under a light anesthetic. Tonometry and funduscopy may

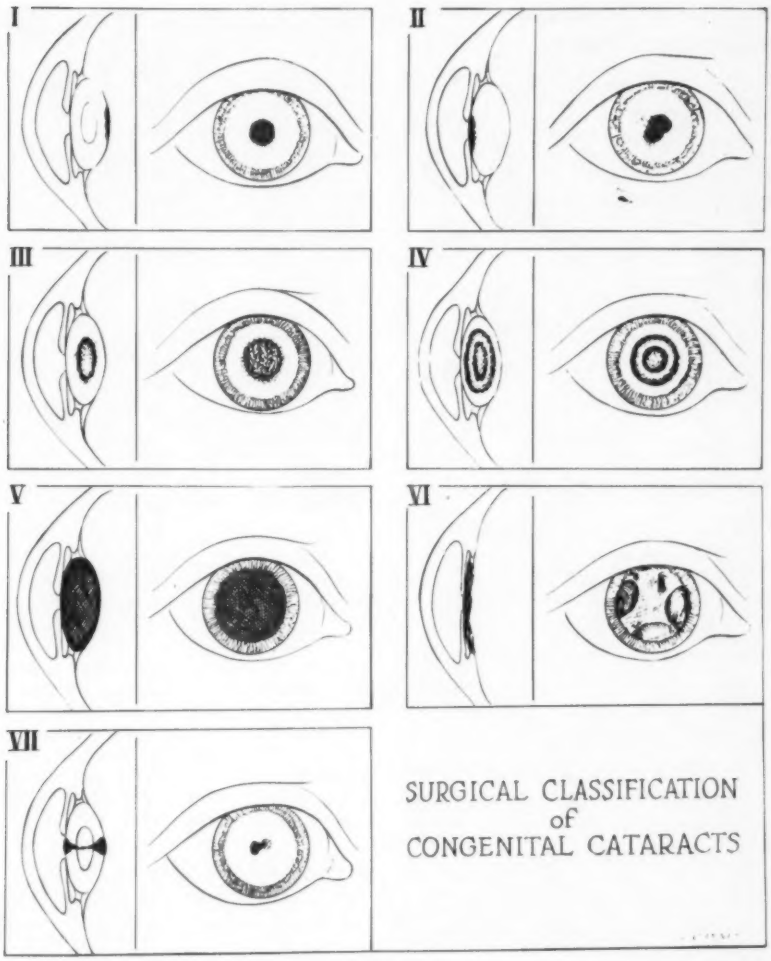

Fig. 1 (Carbajal). Illustration showing the cross section and the front view of the seven types of congenital cataracts. Note that only a representative group of Type VII is illustrated.

then be done. Before the child is put to sleep, he should be examined for gross defects associated with cataracts, such as strabismus, microphthalmia, macrophthalmia, and so forth.

Choosing the surgical procedure

The ideal procedure* for Types IV and V is simple linear extraction, as advocated by Otto Barkan.[13] In Type VI, the Wheeler[14] type of discission is indicated. When a good portion of the cortex looks soft or liquidlike (Types I, II, III, and VII) and even in Type IV, the following procedure may be found satisfactory:

* According to Vail[1] and most ophthalmic surgeons, it is not safe to do an intracapsular cataract extraction in children, even with the use of alpha chymotrypsin. Brownsberger[18] also reiterates this fact, although he once was lucky in performing an unintentional intracapsular cataract extraction upon one child.

Technique

Preliminary preparation

The pupils are maximally dilated, using 10-percent Neosynephrine and Cyclogyl (one percent) drops an hour and a half before surgery, and then every 10 minutes for the last hour before surgery. Subconjunctival injection of adrenalin (1 : 1,000) is rarely necessary. Retrobulbar injection of Xylocaine (one percent) with adrenalin 1 : 1,000 (1.5 to 2.0 cc.) is done to soften the eye and to keep the pupil dilated. Then digital pressure is applied for three minutes to soften the eyeball further.

Actual surgery

1. A self-retaining lid speculum is placed in position.

2. With a Bard-Parker blade (No. 15), a tiny scratch incision is made on the cornea, about a mm. from the limbus, at either the 9- or 3-o'clock position, depending on which is more convenient for the surgeon. The incision should be at least 0.5-mm. deep but never through-and-through.

3. A sharp-pointed short-beveled gauge-19 needle on an empty 2.0 cc. syringe is inserted cautiously through the scratch incision and then directed toward the center of the proximal half of the lens (fig. 2-A and B). The bevel of the needle should face the lens to avoid premature collapse of the anterior chamber as a result of unintentional sucking of the aqueous fluid.

4. When the center of the lens has been reached, suction is gently started. If no liquid enters the syringe, the needle may be thrust a little deeper and suction repeated very carefully. Suction is maintained until some one-fourth to one-third cc. of lens fluid* is withdrawn. It may be helpful to rotate the needle, as well as to move it back and forth half a mm. in order to withdraw the maximal amount of lens fluid. If one is withdrawing only lens material, the anterior chamber usually remains deep, despite obvious softening of the entire eyeball. In a few cases, however, the aqueous rushes into the lens to fill up the "vacuum," and may be sucked out too.

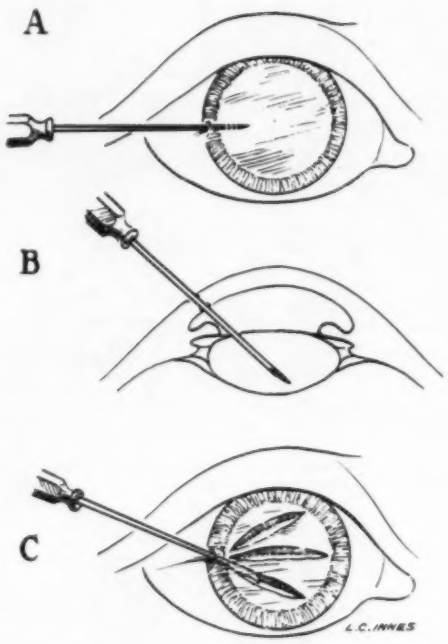

Fig. 2 (Carbajal). Illustration showing procedure for congenital cataract. (A) The needle is introduced through a scratch incision at the 9-o'clock position, and enters the center of the proximal half of the lens. (B) The needle tip must not penetrate the posterior capsule or the vitreous will be injured. (C) The anterior lens capsule is cut in a fan-shaped fashion.

5. The needle is withdrawn, great care being exercised not to enlarge the point of entrance any further.

6. The anterior chamber is reformed with saline, using a gauge-28 needle on a two-cc. syringe.

7. Under ultraviolet illumination,† the anterior capsule of the lens is cut with a Ziegler needle-knife (three-mm. blade)‡ in a

* Lens fluid has a characteristic appearance indicating greater viscosity than water.

† A Hague cataract lamp or any other source of ultraviolet illumination may be used.

‡ Storz Instrument Company has made for me a special needle-knife that can be adapted to a two-

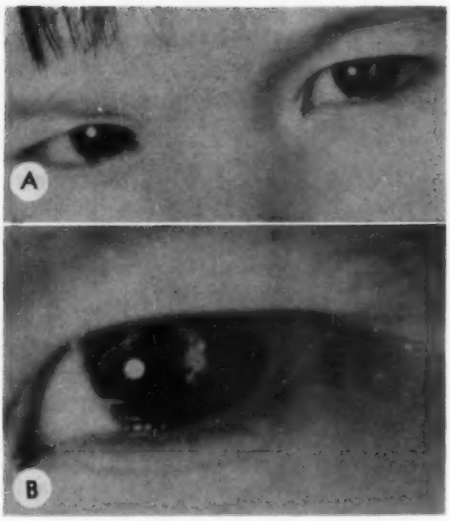

Fig. 3 (Carbajal). A two-year-old Mexican girl with Type I congenital cataract. When seen at the age of nine months, she showed marked searching movements and appeared mentally retarded. Now, wearing glasses all day long, she shows no nystagmus and her movements are much more co-ordinated. (A) Full face. (B) Close-up picture of left eye. Note the residual membrane. Six months after performing the first procedure (suction of the lens with a two-cc. syringe and discission of the anterior capsule with Ziegler needle-knife), the secondary membrane was needled. In the right eye, a Vannas scissors was used to slice the dense membrane, resulting in a rounded black pupil.

fan-shaped fashion, (fig. 2-C) starting along the 9- to 3-o'clock plane, then the 9- to 1-o'clock plane, and finally along the 9- to 5-o'clock plane. The anterior chamber may have to be reformed before each discission, to prevent injury to the vitreous face and the corneal endothelium. The three planes of discission will insure at least one large opening into the lens substance, without cutting into the vitreous face. The unobstructed entrance of aqueous into the lens substance leads to more or less complete absorption of the remaining portions of the lens.

cc. syringe or to a Maumenee handle. This will facilitate suction of the lens material and subsequent refilling of the anterior chamber, minimizing trauma from too many attempts at entering the anterior chamber.

8. The needle-knife is carefully withdrawn and the anterior chamber is reformed with either saline solution or air.

9. In a similar manner, the other eye is operated upon.

10. Atropine (one-percent ointment) and neosporin are instilled into the eyes and eyepads and eyeshields are applied. Elbow restraints are essential for the first 48 hours postoperatively. A good pediatrician will be of great assistance in sedating the child while in the hospital. Sedatives, bilateral eyepads, eyeshields, elbow restraints—these are precautionary measures to discourage overactivity and to prevent the child from harming his eyes.

Presentation of cases

This method has been performed on 18 eyes in 10 patients, all within eight months to two years of age, except one 10-year-old Mexican boy with total cataract, with good results in all except in one case in which vitreous was lost through the small entrance point for the Ziegler needle-knife. In this case, retrobulbar injection had been unintentionally omitted.

Excluding the patient in whom vitreous was lost, there were no postoperative complications such as iritis or glaucoma. Glasses have been fitted in three patients who enjoy wearing their glasses but who are too young to be tested accurately for visual acuity. In the successful cases, the personalities of the children were amazingly changed for the better. The searching nystagmus disappeared completely in one little girl (fig. 3) who for a time was thought to be mentally retarded.

After waiting for an average of four to five months, a second procedure was done in the majority of cases. All that had to be done was to slice a tiny strand of secondary membrane or adhesion that prevented complete dilatation of the pupil. Only in two cases was it necessary to do a third procedure. A Vannas scissors provided excellent help in cutting a rather dense membrane in two patients.

The children undergoing this surgery were kept in the hospital for an average of six days to insure full dilatation of the pupils. Contraction of the pupil postoperatively patches up the rents on the lens capsule and defeats the purpose of the surgery. The less aqueous entering the lens substance, the more slowly absorption occurs. It is therefore imperative that close supervision be carried out by the surgeon himself. Atropine (one-percent ointment), four times a day, and mobilization of the pupil with Neosynephrine (10 percent) and Cyclogyl (one percent) one drop every five minutes for four times, commencing at a specific hour of the day, will prevent serious complications. Cortisone drops every two hours will help promote a quiet eye and perhaps enhance lens absorption.

The results in the lone case in which vitreous was lost would not have been so poor if the parents had been more faithful in dilating the pupils of the operated eye.

Although the follow-up of these patients is no longer than four years, there is enough evidence that the sight of these children will remain good and even improve with use. The following points are the bases for my optimism on prognosis:

First, the vitreous face is not disturbed in the first procedure. In the second procedure only thin strands remain to be cut.

Second, with retrobulbar injection and digital pressure, the prolapse of vitreous into the anterior chamber is prevented.

Third, since the lens material is evacuated as completely as possible, there is definitely a minimal tendency to postoperative iritis and glaucoma from lens material swelling or from blockage of the angle by lens debris.

Fourth, the entrance into the anterior chamber is no larger than that produced by a gauge-19 needle. Therefore, the danger of iris prolapse, loss of vitreous, or infection is much less than in linear extractions.

Comment

This procedure is to be done only in soft cataracts—cataracts that fall under Types I, II, III, or VII. It is certainly not the ideal procedure in those cases in which the entire lens looks hard, especially when the nucleus is brown and very dense. However, whenever there is a suggestion of some soft-looking or liquidlike cortex, this procedure may be tried to full advantage. I have had no occasion to use this method in other types of cataracts (acquired, metabolic, traumatic). There was one patient with a rather dense nucleus which had to be needled after Moncreiff's[16] method. This patient had a good visual result.

This surgical technique in congenital cataract is definitely contraindicated in traumatic cataract when the vitreous has migrated into the anterior chamber.

Suction of the lens cortex was done as early as 1847 when Langier[17] utilized a large needle connected to a syringe for the purpose of evacuating the lens cortex. In 1943, Wolfe[18] proposed a combination of linear extraction and suction of lens cortex through a two-way needle, similar to that of Fuchs'. In 1959, Vargas[17] published the results obtained in 70 congenital cataracts, in which his method of sucking lens cortex and discission was used. The main differences between Vargas' method and that of mine are the following:

1. He destroys the anterior capsule by applying multiple thrusts with the needle, before sucking out the lens cortex. I first do the suction of the lens cortex, exercising great care not to spill it into the anterior chamber. Then I slice the anterior capsule along three planes with the aid of ultraviolet illumination. If necessary, the anterior chamber is refilled with saline before each plane of discission.

2. The needle is thrust in multiple places in Vargas' method, whereas I simply thrust the needle at one point, and keep sucking the lens cortex posteriorly (even the nucleus, if soft), then the lens cortex anteriorly in various depths. In this manner, accidental rupture of the zonules is avoided.

3. He uses a gauge-20 needle attached to a five-cc. syringe, while I use a gauge-19 needle and a two-cc. syringe.

Summary

A modified safe approach in the surgical management of congenital cataract is presented for consideration. The advantages of the procedure are enumerated, emphasis being placed on postoperative care. Results obtained in 18 eyes undergoing the surgery have been satisfactory except in one with vitreous loss. A practical classification of congenital cataract from a surgeon's viewpoint is also presented.

Addendum

This technique has been performed with excellent results in six more eyes, including a case of traumatic cataract in a six-year-old Filipino boy. My special needle-knife was used in all six operations.

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Acknowledgment

I am indebted to Dr. C. Wilbur Rucker for informing me of the work being done by Dr. Enrique Cipriani Vargas on congenital cataracts.

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Ophthalmic Miniature

It may, however, be added that I have noticed a decided tendency to glaucomatous disease in persons who have undergone, late in life, an operation for juvenile cataract.

Sir William Bowman,
Ophthalmic Miscellanies,
Royal London Ophth. Hosp. Reports, **5**:15, 1866.

CONGENITAL CATARACTS

A REVIEW OF EIGHTY-FOUR CASES

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Dallas, Texas

The final visual results after operations for congenital cataract are usually so much poorer and complications so much more frequent than after surgery for cataracts developed later in life that an analysis of even a small group of patients seems justified. The present study includes 25 cases in which simple needling was the primary operation and 59 cases in which linear extraction was done.

Watching these patients for from one to 20 years has led to some observations that seem worthy of recording. One should not be too dogmatic as to the method of operation. My impression is that in patients under two years of age, and probably under four to six years of age, needling is the operation of choice unless the lens, as not infrequently happens, contains a large amount of calcified material which, of course, will not absorb. A small deposit of calcium may be ignored. In patients over four to six years of age, a linear extraction is usually indicated. The term linear extraction is sometimes used rather loosely. If even a small incision is made, a planned capsulotomy should be done and as much of the anterior capsule as possible should be removed. Such a planned capsulotomy was used in most of the cases in the series of linear extractions.

Because of the inclination of a child's iris to draw up toward the site of incision, the incision should be made as small as possible to allow room for the extraction, then closed tightly with sutures. Most operators do a full iridectomy if the pupil dilates poorly and a peripheral iridotomy or iridectomy if the pupil dilates well. In either event, the iris often draws up even though the sphincter is cut below and/or a peripheral iridectomy is made at the 6-o'clock position.

Every ophthalmologist knows that fewer complications occur in older children. In cases of extensive bilateral congenital cataract some ophthalmologists advise operating one eye at the age of six to eight months and waiting two or three years to operate the other eye. This suggests the use of optical iridectomy as a temporary measure when the area of lens opacity is fairly small but centrally placed. This suggestion is usually brushed aside with no comment. In this series, an optical iridectomy down and in was done on three eyes.

One patient had an optical iridectomy down and in on both eyes at the age of five years, with resulting vision of 20/50, R.E., and 20/70, L.E. The patient finished high school, played football, and so forth with this vision. At the age of 21 years, a planned capsulotomy with three peripheral iridectomies above was done on the left eye because of poor driving vision. This operation was advised several years before but refused. At the age of 31 years, the right eye was operated in a similar manner, this operation also being delayed by the patient. Seventeen years after operation on the left eye, vision was 20/20 and seven years after operation on the right eye vision was 20/30.

In a second patient, an optical iridectomy was made down and in at the age of 11 years, followed by planned capsulotomy with one peripheral iridotomy at the 12-o'clock position at the age of 16 years. At the age of 20 years, corrected vision was 20/20. The optical iridectomy was made down and in in order to obtain better reading vision.

These two cases were among my early ones. In later years I was influenced by the opinions of some of the leaders in ophthalmology and probably ignored the advisability of optical iridectomy in some cases. A mydriatic may be used to accomplish a similar purpose but interferes with accommodation. The reason for the optical iridectomy in chosen cases is, of course, to delay the cataract operation until the patient is older and better able to tolerate a lens extraction.

In the first series of congenital cataracts analyzed, there were 14 cases of needling in patients under two years of age. Two required one needling, 12 had two needlings

and one three needlings. Four required removal of part of the secondary membrane. There was no follow-up on one. Observation varied from two to 15 years, with an average of nine years. There were two enucleations, one due to glaucoma after a third needling and one to a severe injury after operation. Visual acuity ranged from 20/60 to finger counting at 12 inches.

In 11 cases of needling after the age of two years (the oldest nine years), five required one needling; four, two needlings; one, three needlings; one, four needlings by another doctor; three required excision of part of the membrane. There was no follow-up on two. Observation time ranged from one month to nine years and visual acuity from 20/20 to 20/100. Ages ranged from two and one-half to nine years, the average being six years. Note the better visual acuity obtained in this older group. However, another explanation has been offered for the difference in final visual results of the two series—that the children with extensive lens cloudiness are more likely to have other congenital ocular deficiencies which influence the final visual acuity. This series is too small to justify an argument but not too small to express an opinion that the age and not the extent of lens clouding makes the difference.

In the 59 cases of linear extractions, six required the use of DeWecker scissors to lower an updrawn pupil, one eye was enucleated for vitreous hemorrhage and detached retina, five ended up with shrunken globes, two with secondary glaucoma, 22 required one or more needlings or use of DeWecker scissors, two had previous optical iridectomies.

Dividing these cases into age groups: eight were one year or under; 10, one to four years; 23, four through eight years; 12, nine through 20 years; and six over the age of 20 years. Most of the shrunken globes followed use of DeWecker scissors to lower an updrawn pupil.

Of the eight patients aged one year or under, four required two needlings; one, three needlings; three had final vision of 20/400, three had vision of 20/200 to 20/60; two had shrunken eyeballs. The time of postoperative observation ranged from three months to seven years (average six years). Ten patients were operated between the age of one to four years. Seven of these were followed postoperatively. Four required use of DeWecker scissors for updrawn pupil or very thick secondary membrane; three required one needling; one ended up with a shrunken globe; one developed secondary glaucoma which was controlled. The final visual acuity ranged from 20/400 in one; 20/200 in four; 20/100 in one and 20/25 in one. Postoperative observation was from two to eight years (average six years). Some of the successful cases improved with the years.

Of the 23 patients between four to eight years of age, four required use of DeWecker scissors later, three required needling at a later date. No follow-up or accurate visual test was done in three. There was a shrunken globe and enucleation in one. Postoperative observation ranged from one month to eight years. Final visual results were 20/20 in two; 20/25 in two; 20/50 in two; 20/60 in one; 20/70 in one; 20/400 in two and 20/100 in one. No accurate visual test was done on the others. Note the higher visual acuity obtained in this older group.

Twelve patients were between nine and 20 years of age. Six required one needling; no follow-up in one; good vision was reported in one who was sent back to a local oculist. Time of postoperative observation was: eight years, two; one year, two; four years, one; five years, one; 16 years, one; three and one-half years, one; six weeks, one; average, seven years. Final vision was 20/50 or better, six; 20/200, one; 20/400, one. In four, no follow-up or accurate visual test was obtained.

Seven patients were over 20 years of age. Needling was required in two. Time of postoperative observation was: 18 months, two; four years, one; two years, one; seven

months, one; six weeks, two; average time one and one-half years. Final vision was 20/30 or better in one; 20/50, one; 20/80, one; 20/200, one; 20/400, two. A summary shows:

LINEAR EXTRACTION CASES

DeWecker used	6
Enucleation	1
Shrunken globe	5
Secondary glaucoma	2
Previous optical iridectomy	2

Of the linear extractions, 22 required needling or DeWecker scissors. In general, the older the patient the better the visual result obtained. Of course, if the opacity involves most of the lens, operation cannot be delayed very long but, when the opacity is small particularly if it is confined to the posterior part of the lens, interference should be delayed for several years if child can carry on fairly well.

The time of postoperative observation in the cases studied is not sufficient to rule out late complications which are known to occur more frequently in congenital cataracts than in senile cataracts in adults. Needling or use of DeWecker scissors, or both, was required in over one third of the linear extractions.

DISCUSSION

Maumenee's method of using a two-way goniotomy knife for flushing out a large part of the cortex is excellent but the cortex would be absorbed anyway in most cases. If a peripheral incision instead of a cross-cut were made in the anterior capsule, as in a planned capsulotomy, some of the anterior capsule could be washed out as well as cortical material, thereby making a subsequent needling less likely. A limbal opening as large as the goniotomy needle is not insurance against drawing up of the iris toward the site of puncture. This might be obviated by making a peripheral iridectomy and closing the puncture wound tightly with one suture.

In a recent excellent article, Cordes, reviewing 112 enucleated eyes which had previously been operated for congenital cataract, says, "detachment of the retina occurring after 10 years included 40% of the detachment cases, the time varying between 10 and 33 years after surgery. In this group 76% had multiple needlings. This confirmed the conclusion drawn from previous study that multiple needling is the least desirable of all procedures."

In order to back up such a statement one would have to estimate the number of multiple needlings and linear extractions performed from 10 to 33 years ago and divide them into age groups. I feel quite sure that the number of needlings is much larger than the number of linear extractions during that time interval. In the last 10 years more linear extractions have probably been done.

CONCLUSIONS

Since I have no new concepts to offer, I hesitate to report such a small number of cases with so many poor results. In their reports the proponents of linear extraction have little to say about subsequent needlings, and so forth. In my experience a considerable percentage of extracapsular extractions, planned or unplanned, in both children and adults, will, if followed long enough, present the problem of a secondary membrane; in children an updrawn pupil presents an additional and frequent complication.

Optical iridectomy seems indicated in young patients with partial lens cloudiness and the cataract should be removed later since the visual results are better and the complications fewer in older patients.

Because uveal or endothelial changes may be present to interfere with the operative results, eyes with congenital cataracts should be examined with the slitlamp and the same care should be used as in adults.

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DESCEMET'S WRINKLES IN DIABETES*

PAUL HENKIND, M.D., AND GEORGE N. WISE, M.D.
New York

In 1935, Waite and Beetham[1] described wrinkling in Descemet's membrane in diabetic individuals. These wrinkles occurred in 26 percent of the 2,002 diabetic patients studied and in only 10.5 percent of the 457 nondiabetic controls. In fact, they were reported to be the most common ocular manifestation of diabetes. The wrinkles were not so bold and differed from the folds seen in hypotony and inflammatory states. Some were visible only in the zone of specular reflection. No correlation between wrinkling, the blood sugar level, insulin dose, or ocular tension was found. Their incidence increased directly with the age of the patient and diabetic individuals seemed to develop them earlier than nondiabetic ones.

Other than reference to Waite and Beetham's work and Leopold's[2] statement of their presence in eight percent of his cases, a review of the literature disclosed no mention of these wrinkles in diabetes.

Agatston[3] and Ballantyne[4] demonstrated an irregular thickening and staining of the capillary basement membrane among the earliest retinal changes in diabetic retinopathy. Fragility of the retinal internal limiting membrane has also been recognized as an integral part of this disease.[4,5] Friedenwald[6] showed that both of these membranes stained brilliantly with PAS. Recently Kimmelstiel[7] discovered a comparable irregular, patchy hyalinization of the tubular capillary basement membrane in the diabetic glomerulosclerotic kidney. The lesion was well demonstrated by PAS and was sufficiently marked in one case to enable the author to suspect correctly diabetes, though no glomerular lesions were seen.

The frequency of Descemet's wrinkles in diabetes and the marked affinity of this membrane for PAS suggested the present study to re-examine and re-evaluate their significance.

MATERIAL AND METHOD

In 1957 and 1958, 133 diabetic and 169 nondiabetic individuals were studied at Bellevue Hospital. Diabetic patients were from the wards and clinics of Bellevue Hospital and ranged in age from seven to 89 years. There were 79 females and 54 males. Each history included date of onset, method of control, quality of control, diabetic complications, ocular and family history. Ocular examination included funduscopy and slitlamp examination in all cases. The cornea was examined by direct, specular, and diffuse illumination. Through the dilated pupil the fundus was examined with the electric ophthalmoscope and the retinal slitlamp. Some patients were examined more than once.

Nondiabetic controls included the staff personnel and ward patients of Bellevue Hospital ranging in age from nine to 83 years. There were 69 females and 100 males. Each history included a systemic review with emphasis on past ocular disease. Each cornea was examined as already outlined. Those patients exhibiting wrinkles were questioned specifically for evidence suggesting diabetes, their fundi were examined as described and blood sugar determinations were made.

Prior to pupillary dilatation finger tensions were taken on all patients and tonometric readings on 20 (11 diabetic, nine control). In all instances the cornea was examined before and after instillation of anesthetic or mydriatic drops. The latter in no way affected the corneal findings.

All patients with any eye disease poten-

* From the Department of Ophthalmology, New York University Post-Graduate Medical School. This study was made under a summer student fellowship No. SF-159 of the National Council to Combat Blindness, and a U. S. Public Health Service grant B-1587 (R1).

TABLE 1

DESCEMET'S WRINKLES IN DIABETIC AND NONDIABETIC INDIVIDUALS

Age (yr.)	Diabetic Patients Examined	Number with Wrinkles	Percent with Wrinkles	Percent Waite & Beetham	Control Patients Examined	Number with Wrinkles	Percent with Wrinkles	Percent Waite & Beetham
1–10	4	0	0	0	1	0	0	0
10–19	4	0	0	0.4	16	0	0	0
20–29	9	0	0	1.4	24	0	0	0
30–39	3	0	0	9.3	20	0	0	3.1
40–49	13	1	7.7	20.0	26	0	0	4.5
50–59	34	15	44.1	37.0	35	3	8.6	6.9
60–69	48	17	35.4	47.6	26	3	11.5	28.2
70-up	18	11	61.0	49.6	21	7	33.3	32.1
TOTAL	133	44	33.1%	26.0%	169	13	7.6%	10.5%

tially affecting the corneal endothelium were excluded from this study. All instances of wrinkles were confirmed by at least two observers.

FINDINGS

Wrinkles in Descemet's membrane were observed in 33 percent of the diabetic and in eight percent of the nondiabetic subjects (table 1). In 77 percent the wrinkles were bilateral. There appeared to be no difference between the wrinkles seen in the two groups studied, although there was usually more extensive involvement in the diabetic patient. All wrinkles, even the smallest, were in every instance visible with high-power direct illumination. By this technique they appeared as fine, shining gray, linear steaks on the posterior surface of the corneal parallelopiped (fig. 1). Widening the beam of light made it possible to trace their full extent. Those observed did not resemble the much grosser folds found in conditions of hypotony, trauma, or inflammation. Usually the wrinkles were vertical or oblique and they were located in the central portion of the cornea. Rarely they assumed a horizontal position, and they were never isolated in the corneal periphery. Occasionally a compound variety, several to many linear steaks emanating from one nidus like a cluster of pine needles, was observed. When examined by specular reflection (fig. 2), the wrinkles appeared as thin dark troughs, outlined by bright tracks. The endothelial surface looked as though cells had been pushed in along the line, no disruption or distortion of cell pattern being visible. No pathologic process affecting the stroma was apparent. In many instances the posterior corneal surface appeared to have an increased density. Other than this no associated pathologic process was seen.

The retinopathy ranged from a single microaneurysm, associated with dilated retinal veins, to massive retinitis proliferans

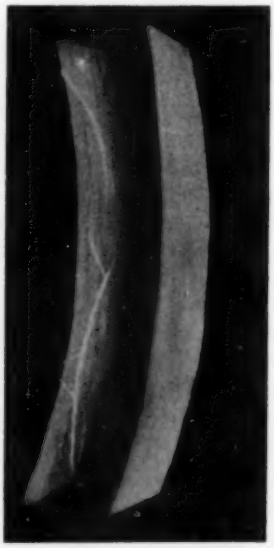

Fig. 1 (Henkind and Wise). Descemet's wrinkles as seen by direct illumination.

and retinal detachment. More than half the diabetic patients having wrinkles had retinopathy of some degree. The association of the two entities increased directly with age. Three patients in this study who had marked retinopathy and negative corneal findings on first examination, subsequently developed persisting wrinkles, all within a year of the first examination.

Ten diabetic patients with wrinkles were observed on two or more occasions over periods ranging from one day to two months. In no instance did the wrinkles become less pronounced. One patient's wrinkles were sketched on five consecutive days. They remained constant over this period. A 500 cc. water load in another diabetic patient failed to affect the wrinkles.

Wrinkles appeared in 13 nondiabetic individuals. They were bilateral in every instance and were only seen in patients over 50 years of age. Two females and 11 males were affected. In this control group wrinkles were found in healthy individuals, as well as those with disease. No single factor other than age could be implicated in their occurrence. Ocular tension in the control patients had no effect on the wrinkles with one exception. This febrile individual (temperature 102°F.), with an ocular tension of 8.5 mm. Hg in each eye, exhibited a linear streak which resembled a large wrinkle. No other corneal or ocular change was seen. Two days later the patient's temperature was normal, his ocular tension 14.5 mm. Hg in each eye and no streaks were visible in either cornea.

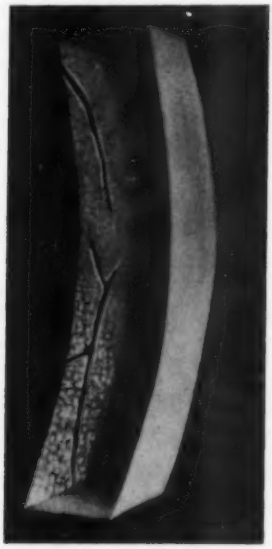

Fig. 2 (Henkind and Wise). Descemet's wrinkles as seen by specular reflection.

TABLE 2

RELATION OF WRINKLES TO KNOWN DURATION OF DIABETES

Known (yr.) Duration	Female	Male	Total
Under 2	1	3	4
2–6	10	6	16
6–10	4	1	5
10–14	9	2	11
Over 14	7	1	8
TOTAL	31	13	44

CONCLUSIONS

The corneal wrinkles described were not specific for diabetes. They were noted in both groups with increasing frequency in aging but appeared earlier in the diabetic patient and occurred twice as frequently in diabetic females. There was no relationship between the development or degree of wrinkling and the method of diabetic control, presence or absence of glycosuria, frequency of other diabetic complications, or the duration of the diabetes (table 2). While no absolute relationship between the presence of wrinkles and the degree of retinopathy was demonstrated, more than half the patients with wrinkles had retinopathy of some degree. It appeared that Descemet's membrane could be affected without simultaneous involvement of the corneal endothelium. No cause for the wrinkles was found.

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ACKNOWLEDGMENT

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VISCOSITY STUDIES OF ASPIRATED HUMAN VITREOUS*

With special reference to its use in retinal detachment surgery

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Vitreous for implantation or transplantation is most frequently obtained at autopsy. Antemortem slitlamp examination is rarely possible and therefore little is known of its quality other than that which may be determined by gross inspection and bacteriologic culture. In the case of injured or diseased eyes removed from living donors, the state of the vitreous may also be unknown.

Degenerative disturbances of the vitreous are exceedingly common. Although most frequent in the elderly, they are seen at all ages. Simple practical tests for evaluating the health and suitability of donor vitreous appear to be needed.

Viscosity measurements offer one such approach. Not only is the viscosity of an implant thought to be important for its own sake, but its level should also serve as a guide to the health of the sample, because of the frequency of local or general liquefaction in degenerative states of the vitreous.

Considerable work has been done on animal vitreous[1-3] but there is little in the literature on the viscosity of human vitreous. Paufique, Fayet and Ravault[4] measured the viscosity of six samples of human vitreous before and after lyophilization and rehydration, and found it the same. Naumann[5] measured postmortem chemical changes nine hours after death. These were less than those of cerebrospinal fluid and consisted mainly of a postmortem rise of urea, with smaller increases of potassium and phosphorus; postmortem glycolysis was slight.

In the studies being reported here, an attempt has been made to determine the feasibility of measuring the viscosity of small quantities of human vitreous and to obtain data on: (1) the range of viscosities in a random group of samples which by common criteria would be considered suitable as implants; (2) the effect of different storage times; (3) the viscosity of rehydrated preserved vitreous; (4) the effect of alpha chymotrypsin and hyaluronidase; (5) the effect of passage through large (18-gauge) and small bore (27-gauge) needles.

Material

Forty-four samples were available for study. These had been stored for times ranging from one hour to seven years and were from three sources:

1. *Eighteen samples from postmortem*

* From the Department of Ophthalmology of the Royal Victoria Hospital and of McGill University, Montreal.

*material at the Institute of Pathology, McGill University, tested one hour to two months after collection.** Aspiration was carried out under aseptic conditions with an 18-gauge needle introduced through conjunctiva and sclera eight or nine mm. behind the limbus.[6] Vitreous was aspirated slowly and the amount limited to 1.5 to 2.0 cc. Collection was within 24 hours of death. All donors were over 16 years of age. Patients with a history of intraocular disease, high myopia, diabetes and jaundice were excluded. Vitreous from infants was so highly viscous that it was difficult to aspirate and could not be measured by our technique. Cloudy or icteric samples or those containing pigment particles were rejected. The material from each eye was injected into a separate rubber-stoppered vial through a second sterile 18-gauge needle, none being pooled. These were replaced in a refrigerator at 4°C. and not disturbed except for viscosity determinations. Most samples, despite general clarity, showed nonpigmented floccular sediment which settled to the bottom of the vial; these were retained.

Seven samples were tested within one hour of collection and at intervals up to one to four weeks. Between tests, these were not removed from the viscosimeter pipettes, which were kept in the ice-box at 4°C., their ends plugged to prevent evaporation. Eleven other samples were tested two weeks to two months after collection.

2. *Sixteen samples from the Eye-Bank for Sight Restoration, Inc., New York.*† *Duration of storages six months to seven years.* These were also taken from postmortem material through an 18-gauge needle and stored in rubber-stoppered vials at 4°C., as described by Shafer.[7,8] Fifteen were samples from two eyes of the same donor; one was from a single eye. Transfer to Montreal was by Air Express. They were refrigerated en route and were placed in our icebox within a few hours of leaving the Eye-Bank. They were not disturbed again except for viscosity determinations.

3. *Ten samples of lyophilized (preserved) vitreous.*‡ Time from death to lyophilization was from 22 to 55 hours, with the exception of two samples where nine days had elapsed. Time between lyophilization and rehydration was from two weeks to four months. The material was collected with a 15-gauge needle from eyes enucleated at autopsy and was not pooled. A 1.0 cc. antibiotic solution containing neomycin, polymyxin B, and gramicidin§ had been added to each of five samples before freezing and lyophilization. The method of preservation has been described.[9–11] Each came as a dry white powder, indicating satisfactory preservation; none showed the color changes or shrinkage that have been described[11] when a high vacuum has not been maintained.

Method

An Ostwald type viscosimeter pipette with 0.5 mm. diameter bore‖ that would allow determinations of viscous solutions in quantities of 0.75 cc. was designed and found satisfactory.

Relative viscosities were measured,¶ the

* These will be referred to as R. V. H. (Royal Victoria Hospital) samples.

† We are indebted to Dr. Donald M. Shafer, New York, for supplying us with this material.

‡ We are indebted to Dr. John Harry King, Jr., and Dr. John W. McTigue, Washington, D.C., for supplying us with this material.

§ Neosporin solution, Burroughs, Wellcome and Co., Inc., Tuckahoe, New York.

‖ Made by Fisher Scientific Co., Montreal.

¶ Viscosity of a fluid may be defined as its resistance to flow and is the reciprocal of fluidity. It may be expressed in terms of absolute or relative viscosity. In this study, we have measured the latter, using distilled water as reference fluid, and giving it an arbitrary value of 1.00. A viscosimeter pipette is a U-shaped glass capillary tube, with upper and lower chambers, through which a constant volume of fluid is allowed to flow by gravity, the temperature also being kept constant. The tube is loaded with the required volume of the sample (here 0.75 cc.) and placed in a constant temperature water bath until it has assumed bath temperature (here 37°C.) Excess fluid is removed by micropipette. By positive pressure, using a rubber bulb attached to the other end of the tube, the sample is forced into the upper chamber. By de-

TABLE 1

RELATIVE VISCOSITIES OF R.V.H. AND EYE-BANK VITREOUS, STORED AT 4°C., AND OF LYOPHILIZED VITREOUS*

R.V.H. Vitreous			Eye-Bank Vitreous		Lyophilized Vitreous		
Duration of Storage			Duration of Storage		Time between Death and Lyophilization		
1 hr.	24 hr.	2 to 8 wk.	6 to 24 mo.	2 to 7 yr.	20 to 30 hr.	30 to 60 hr.	8 da.
1.96	1.59	1.19	1.29	1.09	1.53	1.20	1.17
2.02	1.86	1.20	1.39	1.23[b]	1.82	1.33	1.22
2.18	1.89	1.25	1.81	1.39[b]	1.87	1.42	
2.40	2.18	1.30	1.90	1.44	3.11	1.43	
2.41	2.31	1.31	1.94	1.45			
2.91	2.32	1.33	1.96	1.46			
3.70	2.41	1.33	2.77[a]	1.50			
		1.39		2.31[c]			
		1.52		3.65[d]			
		1.58					
		1.59					
		1.61					
		1.68					
		1.73					
		1.82					
		1.93					
AVERAGES: 2.52	2.05	1.49	1.87	1.72	2.08	1.35	1.20

* All samples in their gross appearance satisfied common criteria for use as implants. They are listed for convenience in ascending order of viscosity.

[a] 16 mo. storage.

[b] 7 yr. storage.

[c] 36 mo. storage.

[d] 30 mo. storage.

reference fluid being distilled water. Samples to be tested were transferred to the pipettes in a sterile 2.0-cc. syringe with 18-gauge needle. Care was taken to avoid visible sediment, which would interfere with flow and invalidate results. Determinations were made at 37°C., using a constant temperature water bath with thermoregulator accurate to within 0.1°C. Flow time was recorded with a stopwatch with automatic starter, accurate to within 0.2 seconds, the average of five readings being taken. Reproducibility of the readings indicated the accuracy of the system.

termining the time for a known volume of fluid, at known constant temperature, to fall through a known length of tubing, the relative viscosity of the fluid may be determined when compared with distilled water, by the following formula:

$$\frac{\text{Time in seconds for sample}}{\text{Time in seconds for distilled } H_2O} = \text{Viscosity of sample relative to distilled } H_2O$$

RESULTS AND COMMENT

A. RANGE OF VISCOSITY LEVELS

Table 1 shows the relative viscosities of all samples. In each group and at each time tested, there was a wide range. Samples with both high (for example, > 3.00) and low (for example, < 1.50) viscosities were found in each group.

Too strict a comparison of material from the three sources should not be attempted; nevertheless there was considerable uniformity of results. There was also a good correlation with the levels reported by Paufique, Fayet and Ravault,[4] whose samples ranged between 1.4 and 3.0 with an average relative viscosity of 1.9.

Table 2 shows that the viscosities of vitreous from fellow eyes of the same donor were similar in eight of 10 pairs tested. This lends added support to the validity of the determinations. An occasional difference be-

TABLE 2

COMPARISON OF RELATIVE VISCOSITIES OF BOTH EYES OF THE SAME DONOR

Vitreous	Relative Viscosities		Difference
	1st Eye	2nd Eye	
Stored	1.19	1.20	0.01
	1.31	1.33	0.02
	2.40	2.44	0.04
	1.33	1.58	0.25
	1.68	1.93	0.25
	2.18	2.91	0.73
Lyophilized	1.17	1.22	0.05
	1.20	1.33	0.13
	1.53	1.87	0.34
	1.82	3.11	1.92

tween two eyes is to be expected on the basis of unilateral eye disease.

All samples satisfied usual gross criteria for suitability as implants.[7] Extremes of viscosity could be appreciated at time of aspiration and later by tilting the vial. However, accurate viscosimetry was needed to differentiate the viscosities of most of the samples.

The wide range of viscosities in each group is consistent with the known frequency of vitreous degeneration and liquefaction, especially in the elderly, and suggests that viscosity determinations should be made routinely before implantation, so that the less viscous samples may be discarded. Minimum "acceptable" or minimum "desirable" levels can only be defined arbitrarily and will probably vary depending upon the availability of samples. A correlation of surgical results with gross differences in viscosity would be of interest. Clark[12] has called attention to "occasions where the injected vitreous has seemed to have none of the expected actions" and has suggested that in these cases "the donor vitreous might not be normal."

B. Effects of storage time

Samples stored for the shortest period of time (either in vivo or in vitro) showed the highest viscosities (table 1), namely: (a) *R.V.H. samples:* the average viscosity of seven samples tested one hour after collection was 2.52; the average viscosity of 16 samples tested after 2 to 8 weeks of storage was 1.49. (b) *Lyophilized vitreous:* the average viscosity of four preserved samples which had been lyophilized within 30 hours of the donors' death was 2.08; the average of six samples lyophilized later (34, 47, 55, and 216 hours after death) was 1.30.

Table 3 shows that seven samples tested at repeated intervals from one hour to three weeks after collection suffered partial loss of viscosity with increasing time of storage. Greatest decrease was during the first week (average loss 23.5 percent) and the major portion of this occurred during the first 24 hours (average loss 15.7 percent). There was no further significant loss at three weeks. The extent of viscosity decrease in

TABLE 3

CHANGES IN RELATIVE VISCOSITIES AFTER STORAGE AT 4°C.*

Vitreous Sample No.	Duration of Storage				
	1 hr.	24 hr.	1 wk.	2 wk.	3 wk.
1	2.40 (100)*	2.18 (82.8)	1.73 (72.1)	1.62 (67.5)	1.73 (72.1)
2	2.44 (100)	2.31 (94.7)	1.88 (77.0)	1.82 (74.6)	1.82 (74.6)
3	2.02 (100)	1.89 (93.6)	1.67 (82.7)	1.52 (75.3)	1.52 (75.3)
4	1.96 (100)	1.59 (81.1)	1.59 (81.1)	1.59 (81.1)	1.59 (81.1)
5	2.18 (100)	1.86 (85.3)	1.74 (79.8)	1.61 (73.9)	—
6	3.70 (100)	2.41 (65.1)	2.46 (66.5)	—	—
7	2.91 (100)	2.32 (79.7)	—	—	—
AVERAGE*	(100)	(84.3)	(76.5)	(74.5)	(75.8)

* The figures in parentheses indicate the viscosities as percentages of the one-hour reading.

TABLE 4

RELATIVE VISCOSITIES OF PRESERVED VITREOUS

Vitreous	Time		Relative Viscosity
	Death to Lyophilization (hr.)	Lyophilization to Rehydration (wk.)	
Without neosporin	22	2	1.87
	22	2	1.53
	34	2	1.33
	34	2	1.20
	47	2	1.47
With neosporin	29	16	3.11
	29	16	1.82
	55	8	1.43
	216	4	1.17
	216	4	1.22
		AVERAGE	1.61

individual samples varied from 19 percent to 33.5 percent.

There is a suggestion here that after an initial reduction during the first few days, the viscosity of stored vitreous is then maintained. Consideration of the viscosity levels of the Eye-Bank samples stored for six months to seven years gives support to this: (a) The average viscosities of samples stored six to 24 months and of those stored two to seven years were approximately the same; (b) The average viscosity of Eye-Bank samples was slightly higher than the average of 16 R.V.H. samples stored for lesser periods (two weeks to three months), and the viscosities of individual samples compared favorably to them.

It has been known that vitreous isolated from animal eyes gradually loses viscosity with standing,[2] and that if a small amount is added to a solution of hyaluronic acid from another source, the viscosity of the latter is reduced.[13-14] This decrease in viscosity has been ascribed by some to the action of ascorbic acid catalysed by traces of copper[2, 15] and by others[14] to the action of hyaluronidase. Brunish, Rowen and Irvine[14] found that beef vitreous, acting on umbilical hyaluronate, had a depolymerization activity equivalent to that of one to two viscosity units per cc.

From our observations in this small series, it would seem that:

1. Vitreous should be removed from donor eyes as soon as possible after death or enucleation.

2. Vitreous should preferably be implanted as soon as possible after collection.

3. Some viscosity will have to be sacrificed while awaiting bacteriologic confirmation of the sterility of the sample (the risk of proceeding without a negative culture is too great to be justified).

4. Among older samples, many will have maintained good viscosity and may be used as implants.

5. Freezing and lyophilization should be commenced as soon as possible after collection. Since there is evidence that the powder can be stored for several months without change,[4, 9-11, 16, 17] lyophilization may provide a means of "trapping" the high initial viscosity until the sample is needed.

C. VISCOSITY OF PRESERVED VITREOUS

Table 4 summarizes data on 10 samples of preserved vitreous. In this small group, there is a correlation between viscosity and the time from death to lyophilization (see also table 1). There is no correlation between viscosity and the time from lyophilization to viscosity testing. The addition of 1.0

TABLE 5

RELATIVE VISCOSITIES BEFORE AND AFTER ADDITION OF 0.5 MG. ALPHA CHYMOTRYPSIN IN 0.2 CC. STERILE DISTILLED WATER

Initial Viscosity	Viscosity with Alpha Chymotrypsin	
	At 5 min.	At 1 hr.
1.2	1.1	1.1
1.6	1.1	1.1
2.3	2.0	2.0
2.4	2.2	2.2

cc. neosporin before lyophilization did not have an adverse effect on viscosity.

Concentrated forms of preserved vitreous are being recommended for clinical use[4, 11] because these may be further diluted and expand in the recipient eye to give the retina support. To do viscosimetry of preserved vitreous requires that it be in solution, because floccular sediment interferes with capillary flow. It was therefore not possible to measure the viscosity of these concentrated forms.

After preliminary observation that 50 percent rehydration would not provide clear solutions, all samples were reconstituted to their original volumes for testing. In the case of two samples, difficulty was experienced in attaining solution and the levels recorded (1.33 and 1.43) probably represent a maximum. In the case of others, solution might have been attained with lesser amounts of diluent, which would have resulted in higher viscosities.

We do not know the original viscosities of these samples before freezing. Attention has already been drawn to the report of Paufique, Fayet and Ravault,[4] who found viscosities before and after lyophilization to be the same.

TABLE 6

RELATIVE VISCOSITIES BEFORE AND AFTER ADDITION OF 7.5 TRU HYALURONIDASE IN 0.2 CC. STERILE DISTILLED WATER

Initial Viscosity	Viscosity with Hyaluronidase			
	At 5 min.	1 hr.	2 hr.	3 hr.
1.19	1.10	1.07	1.05	1.05
1.19	1.08	1.06	1.06	1.06
1.20	1.10	1.05	1.05	1.04
1.33	1.17	1.10	1.09	1.09
1.58	1.22	1.13	1.12	1.12
1.61	1.29	1.19	1.15	1.15

TABLE 7

RELATIVE VISCOSITIES OF VITREOUS AFTER PASSAGE THROUGH 18-GAUGE AND 27-GAUGE NEEDLES*

Vitreous	Sample No.	18-Gauge Needle	27-Gauge Needle
R.V.H.	1	1.19	1.19
	2	1.20	1.20
	3	1.31	1.32
	4	1.33	1.33
	5	1.33	1.30
	6	1.39	1.39
	7	1.58	1.52
	8	1.68	1.59
	9	1.93	1.91
	10	3.70	3.25
Eye-Bank	11	1.09	1.09
	12	1.23	1.52
	13	1.29	1.29
	14	1.39	1.39
	15	1.39	1.39
	16	1.44	1.44
	17	1.45	1.45
	18	1.46	1.46
	19	1.50	1.50
	20	1.81	1.82
	21	1.90	1.90
	22	1.94	1.97
	23	1.96	1.96
	24	2.31	2.31
	25	2.77	2.96
	26	3.65	3.79
	AVERAGE	1.74	1.74

* Samples are listed for convenience in ascending order of viscosity.

D. EFFECTS OF ALPHA CHYMOTRYPSIN AND HYALURONIDASE

Table 5 shows that the addition of 0.5 mg. of alpha chymotrypsin in 0.2 cc. distilled water to four samples of stored vitreous had no appreciable effect on viscosity, confirming in vivo observations and giving further reassurance about the use of this enzyme in cataract surgery. The small reduction can probably be explained by the dilution effect.

On the other hand, the addition of 7.5 t.r.u. of hyaluronidase* (table 6) in the

* Wydase-lyophilized hyaluronidase, Wyeth, Inc.

same volume of diluent caused a marked reduction in the viscosities of each of six samples. This effect was greatest during the first five minutes. Since the action of hyaluronidase is a specific one, the major part of the viscosity of vitreous aspirate may be attributed to hyaluronic acid.

E. Effects of passage through large and small bore needles

Table 7 shows that there was no reduction in the viscosities of 26 samples of vitreous after passage through a 27-gauge needle, as compared to passage through an 18-gauge needle.

Difference of opinion exists regarding implantation through a large or small bore needle. Those favoring the 18-gauge needle through a sclerotomy incision do so mainly on the premise that viscosity may be reduced after passage through the 27-gauge needle. Pischel[18] has reported favorably on implantation through a 27-gauge needle. At this hospital, we have also been favorably impressed with its use. Injection through the 27-gauge needle is simpler, safer and less traumatic. Aspiration of vitreous, however, is not possible, once injected, and we have found that if a high pressure is built up, this may sometimes have to be reduced by paracentesis.

Summary

1. The feasibility of obtaining reproducible and accurate measurements of the viscosity of aspirated human vitreous to be used for implantation, has been shown in studies of 44 samples. An Ostwald type pipette with 0.5-mm. diameter capillary bore, needing 0.75 cc. of vitreous, proved suitable. If the vitreous from two eyes of the same donor is pooled, enough is available for viscosimetry, culture and implantation.

2. There was a wide range of viscosities from a low of 1.09 to a high of 3.70.

3. There was a decline in viscosity during the first week, varying from 19 to 33 percent in seven samples tested; after this there was little further loss.

4. The viscosities of 10 samples of lyophilized vitreous compared favorably with those of stored vitreous.

5. Alpha chymotrypsin had no effect on viscosity; hyaluronidase produced a rapid and marked loss.

6. Aspirated vitreous can be implanted through a 27-gauge needle with no change in viscosity.

7. Viscosity determinations should be made routinely before implantation, so that the less viscous samples may be discarded. Some viscosity will have to be sacrified while awaiting bacteriologic confirmation of sterility. Even among older samples, however, many with a good viscosity will be found.

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COLLATERAL CIRCULATION TO THE EYE*

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It is the purpose of this paper to present a case in which the collateral circulation to the eye is confirmed by means of the techniques of ophthalmodynamometry and electroretinography.

Interest in retinal blood supply has been restimulated by recent work in the fields of ophthalmodynamometry and electroretinography. Ophthalmodynamometry is a technique for obtaining a relative measure of retinal arterial blood pressure and is believed to be of diagnostic value in cases of unilateral internal carotid insufficiency.[1-10] Electroretinography is a technique for recording alterations in the corneoretinal potential and has been reported to show abnormalities in recorded potential when the central retinal artery is occluded.[11,12]

The retina, for its nourishment, depends upon the central retinal artery and its branches, and on the branches of the short posterior ciliary arteries in the adjoining choroid. These retinal and choroidal vessels are derived from the ophthalmic artery which in turn arises from the internal carotid.

It is known that ligation of the internal carotid artery before and after it gives off the ophthalmic artery (the so-called "trap operation" which isolates the ophthalmic artery) or ligation of the ophthalmic artery itself close to its origin, does not usually result in homolateral blindness. Apparently, sufficient blood still reaches the eye. It is believed that the retinal blood supply in such cases is maintained by anastomoses of certain branches of the ophthalmic artery with branches of the external carotid artery. Incidentally, these same anastomoses can furnish collateral circulation to the brain in cases of internal carotid thrombosis.[13,14] In cases of ligation of the ophthalmic artery itself, close to its origin, additional collateral circulation is obtained by means of small recurrent branches of the ophthalmic artery which pass back through the sphenoidal fissure to join similar branches from the internal carotid.

*From the Presbyterian Medical Center, San Francisco, and the Division of Ophthalmology, Stanford University School of Medicine, Palo Alto, California. Aided in part by Public Health Service Grant B-2633 and Office of Naval Research Contract, NONR Contract 3009 (00).

Fig. 1 (Tamler and Takahashi). Narrowed arterioles in homolateral right eye.

This collateral circulation has been demonstrated experimentally in animals[15] and radiologically (by arteriography)[16-18] but, as far as we know, the case to be presented here is the first time that it has been confirmed clinically by means of the techniques of ophthalmodynamometry and electroretinography.

In the case to be presented, both the internal carotid and the ophthalmic arteries on the same side were ligated during an operation for craniopharyngioma. Postoperatively, collateral circulation to the homolateral eye was evaluated by means of fundus photography, ophthalmodynamometry, and electroretinography.

Case report

A 15-year-old girl was seen in consultation in early April, 1959, because of progressive visual loss over a period of nine years. Her history showed that she was born at full-term after an uneventful pregnancy, and her early development was said to have been normal. When she was about six years of age, she was involved in an auto accident and received a right-sided scalp laceration. Shortly after this, she developed visual complaints referable to the right eye. The family was led to believe that the loss of visual acuity was related to the head injury. Since that time, she has had progressive loss of vision in the right eye, frequent headaches, and showed evidence of marked retardation in growth. She never menstruated and failed to develop any secondary sexual characteristics. Recently, there was some impairment of vision in the left eye and a cerebral seizure consisting of loss of consciousness and a generalized tonic and clonic convulsion.

Physical examination revealed panhypopituitarism with marked retardation of physical growth and secondary sexual characteristics. No significant abnormality was detectable on neurologic examination. X-ray films of the skull showed evidence of a rather large, calcified suprasellar mass extending into an enlarged sella turcica. There was thinning and backward tilting of the dorsum sellae and separation of the cranial sutures.

Eye examination revealed no light perception, right eye. Best correctible acuity, left eye, was 20/60. The right pupil reacted consensually but not directly to light. A moderate right exotropia was present. Ophthalmoscopy showed bilateral primary cavernous optic atrophy with circumpapillary, pigmentary degeneration giving a halo effect around the disc. Visual fields showed a large temporal defect, left eye.

A diagnosis of craniopharyngioma was made and on April 16, 1959, a right frontal craniotomy and partial removal of the tumor were performed. During this procedure, the right internal carotid was torn and clipped, and the right ophthalmic artery was coagulated and divided near its origin, both procedures being performed under direct observation.

Here, then, was a case in which both the internal carotid and the ophthalmic artery on the same side were cut. Postoperatively the retinal blood flow to the homolateral eye could not be tested by the effect on acuity since this eye was already blind. However, it could be assessed in a relative manner

Fig. 2 (Tamler and Takahashi). Normally discernible arterioles in contralateral left eye.

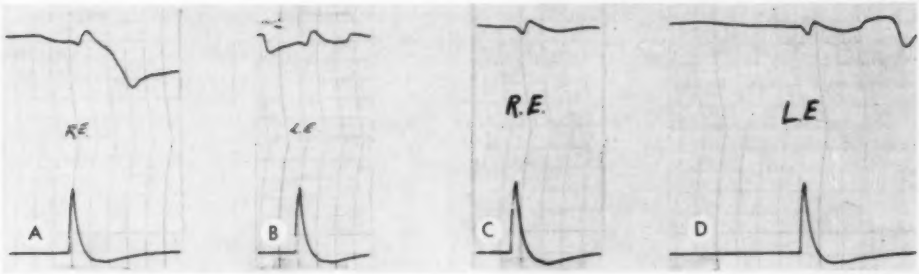

Fig. 3 (Tamler and Takahashi). No difference between electroretingorams of right and left eye. (A) and (B) were taken with lower intensity stimulus (80 lux 0.5 mV/cm.); (C) and (D) with higher intensity stimulus (800 lux 0.5 mV/cm.).

by fundus photography, ophthalmodynamometry, and electroretinography of both eyes.

Sixteen days postoperatively, fundus photographs were taken which confirmed the ophthalmoscopic finding of definite narrowing of the arterioles of the right eye (fig. 1) as compared with the left eye (fig. 2). Ophthalmodynamometry performed on the same day, and again three and five months postoperatively, showed no significant difference in retinal arteriolar diastolic and systolic pressures between the two eyes. Electroretinography performed three and one-half months postoperatively also showed no detectable difference between the two eyes (fig. 3).

Discussion

Complete occlusion of the central retinal artery has consistently resulted in abnormal electroretinographic tracings and abnormally low retinal blood pressures.[11,12] In this case, the normal response of the right eye to electroretinography and ophthalmodynamometry means that, in spite of narrowing of the retinal arterioles, the collateral circulation adequately replaced the ophthalmic artery circulation, enabling the central retinal artery to receive and carry sufficient blood to the retina. In this manner, retinal arteriolar blood pressure and enough retinal function were maintained to give normal electroretinographic and ophthalmodynamometric reponses.

Summary

A case is described in which the internal carotid and ophthalmic arteries were ligated on one side under direct observation during an operation for craniopharyngioma. Although postoperative fundus photographs revealed narrowed arterioles on that side, ophthalmodynamometry and electroretinography confirmed the presence of a relatively normal retinal blood flow derived from the collateral circulation to the eye.

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COMPARATIVE AND EXPERIMENTAL STUDIES ON THE IRIS OF PRIMATES*

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The histologic structure of the iris in various birds and mammals such as rodentia, carnivora, ungulata, columba or buteo has been investigated previously.[7,8] In these species a very regular pattern of connective tissue could be found within the stroma layers. In tangential sections or flat preparations collagen fibers appear curved, interlacing and crossing at the same angle (fig. 1). In dog and rabbit eyes, it was shown experimentally that the angles of this fiber-system change in accordance with the diameter of the pupil.

Although, in principle, the same pattern has been found in human eyes, its structure differs somewhat when compared to the just mentioned animals. The chief differences are:

Separation of the anterior and posterior border layer; loosely arranged connective tissue; often hyalinized adventitia of blood vessels; and the appearance of various clefts or channels within the stroma.

In this connection, it was of interest to investigate the iris structure in primates. There is no consensus about several morphologic problems of iris structure. Concerning the anterior border layer, for instance, based on silver-impregnated flat preparations of human tissue, Margari[5] described a continuous endothelial layer on the iris surface. Margari and Purtcher[6] denied the existence of openings or apertures of any kind in the superficial endothelium. On the other hand, electron microscopic studies by Tousimis and Fine[12] as well as experimental studies by Gregersen[4] have shown the presence of large defects or crypts in the anterior border layer which continue as channel-like spaces within the stroma.

The functional architecture of the stroma has likewise been subject to controversy in recent literature. Ultramicroscopical investigations of human iris, for instance, described a random orientation of the stroma fibers.[12] Histologically, however, in laboratory ani-

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mals, as well as in some human eyes, a regular pattern of connective tissue can be observed.[6,7,9,10]

In this presentation, some of these problems will be discussed from the standpoint of comparative anatomy. If one compares the histologic appearance of the iris in various species of primates certain differences in structure are found which seem related to the process of evolution. Such a study may throw light on the origin of the peculiar structure in the human iris. Apertures or crypts on the anterior border layer, the functional architecture of the fiber system, the construction of the blood vessels, and so forth, are not unique for the human iris but are found in many species of primates. Nevertheless, great variations exist among different species and suggest an evolutionary process.

Material and Methods

For histologic and histochemical examinations, eyeballs of various species from the following families of primates were used: In the suborder of Prosimiae—Tupaia, Lemur, Lori, Nycticebus, Perodicticus and Galago; in the suborder of Simiae—Nycticebus (Aotes), Alouatta, Cebus, Saimiri, Ateles, Leontocebus, Macacus, Cercopithecus, Erythrocebus, Hylobates, Orang-Utan, Chimpanzee and Gorilla. The eyes were partly embedded in celloidin, partly in paraffin. For the most part, cross-sections were made but, in addition, flat preparations or tangential sections of the iris using freezing techniques were carried out in certain selected cases. The following staining methods were used: Tron-hematoxylin by Heidenhain, Azan (Heidenhain), trichrome staining (Goldner-Masson), hematoxylin-eosin, periodate-Schiff-reaction (McManus), resorcin-fuchsin-nuclear-fast-red (Weigert) and others.

Findings

1. The iris stroma in primates

Each species of monkey seems to have a characteristic iris structure, typical for that particular animal. However, the various groups show some general features such as the formation of several layers within the iris, the pattern of the connective tissue, the structure of the anterior surface and the general distribution of pigment. In addition it is possible to describe an evolutionary process of the iris structure—from Prosimiae to Simiae and Hominoidae.

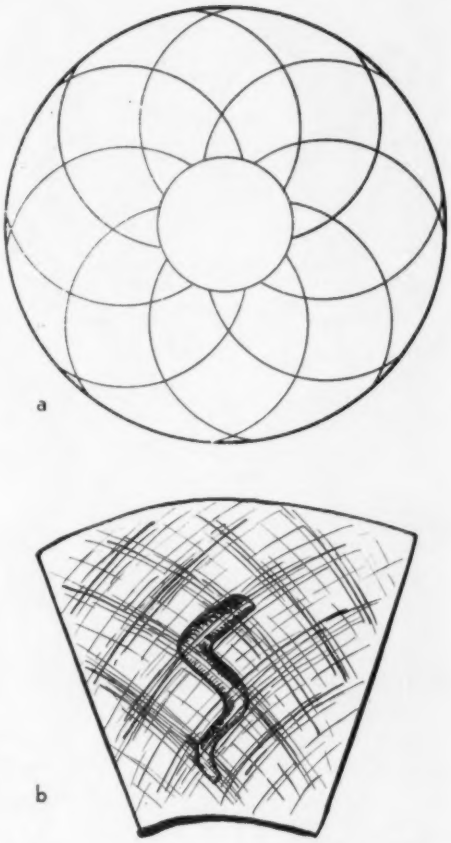

Fig. 1 (Rohen). Schematic drawing of the stromal architecture in the iris as seen in flat preparations. (a) Pattern of the connective tissue. (b) Relationship between stromal pattern and blood vessels.

In lower species of monkeys, except Tupaia, the iris reveals a dense, regular stroma pattern, consisting of collagenous fibers, similar in size and structure. Separation be-

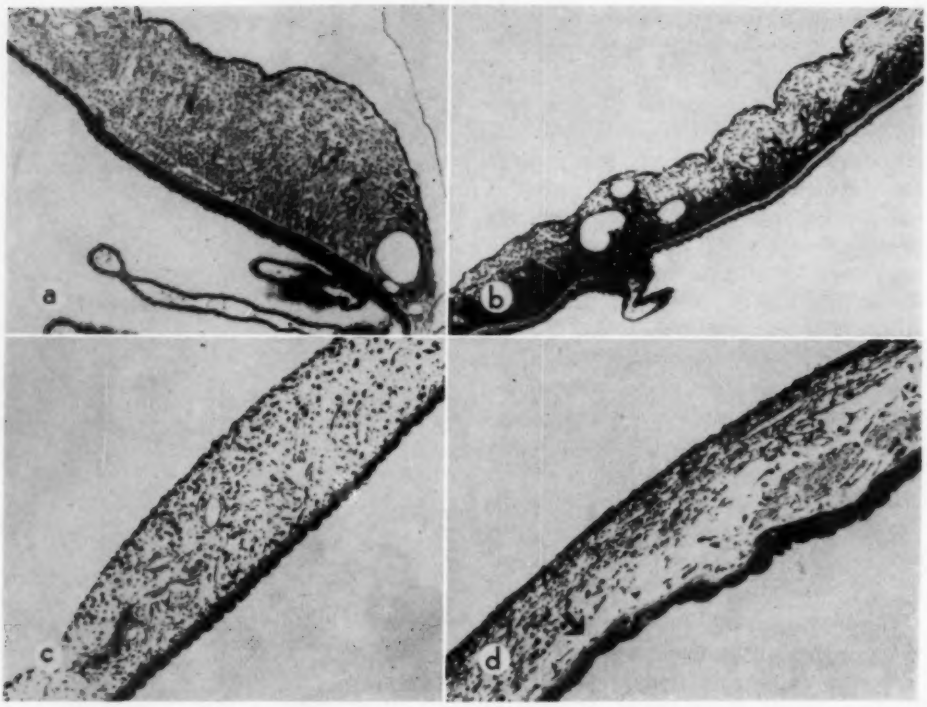

Fig. 2 (Rohen). Cross sections of the iris in four different species of primates. (a) Lemur fulv. (×70, Goldner stain). (b) Galago semid. ovii. (×70, Goldner stain). (c) Aotes tard. (×70, Goldner stain). (d) Hylobates (×100, Goldner stain). (a) and (b) show the typical iris structure of Prosimiae, (c) and (d) of Simiae. Notice the changes in the localization of pigment; in the structure of the connective tissue and the organization of the anterior border layer. In Hylobates (fig. 2-d) already a well-developed cleft of Fuchs can be seen (arrows).

tween the anterior and posterior border layer, especially between stroma and muscle layer, is absent. Specifically, in flat preparations or frozen sections, the collagen fibers show the regular interlaced pattern, described in the introduction (fig. 1). A similar pattern was also observed previously in laboratory animals.[6, 7, 9, 11] The collagen fibers lie close together, filling out the iris completely and evenly with very little ground-substance located between them (fig. 2-a). The arrangement of the blood vessels follows the general tissue pattern in so far as the angles of the crossing and interlacing fibers are concerned (fig. 3-a). Between the blood vessels and the stroma the same functional correlation as previously described in the case of mammals seems to exist. Another characteristic feature of the iris structure in Prosimiae is the concentration of pigment cells in the posterior layer (fig. 2-b). This is most clearly demonstrated in Lorisiformes and

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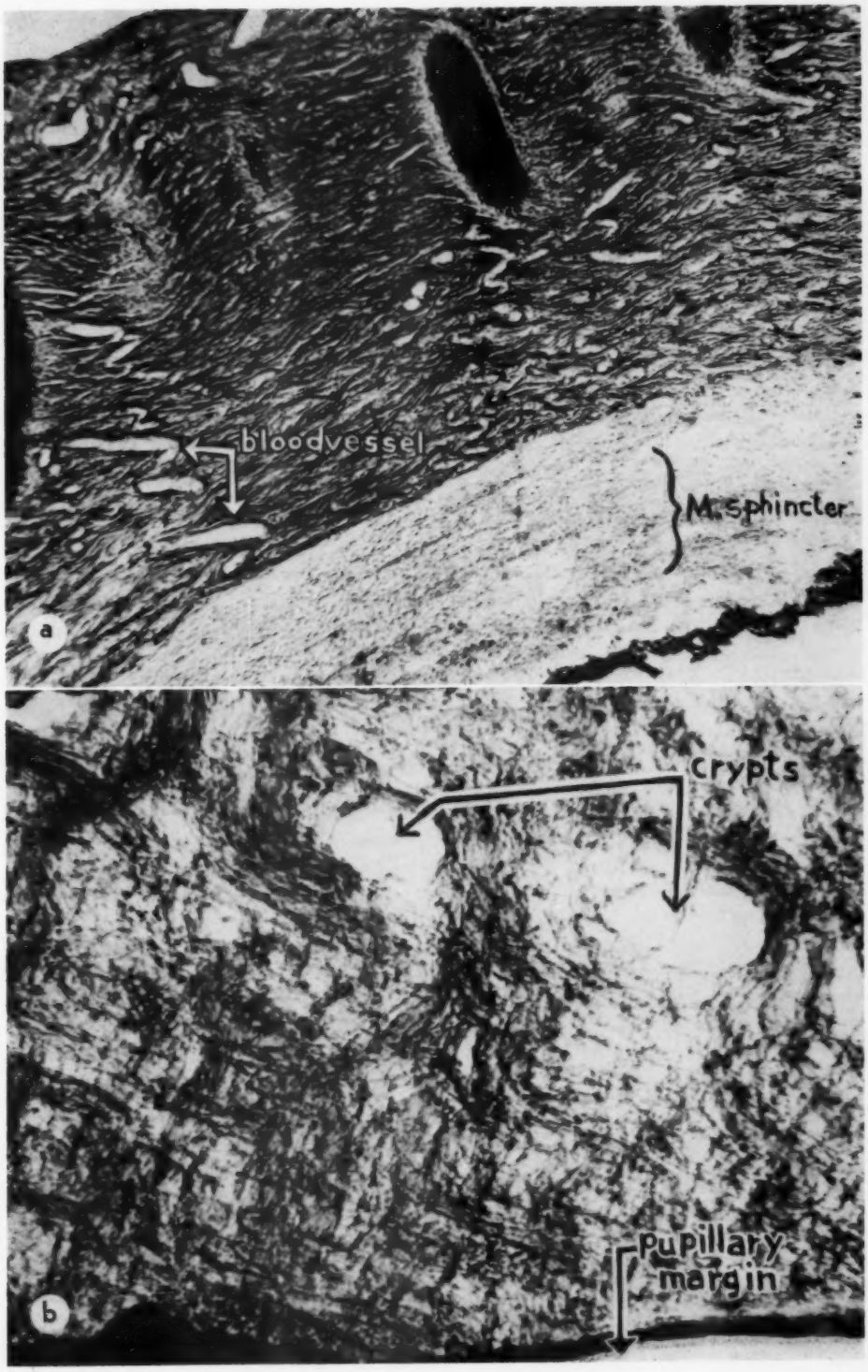
Fig. 3 (Rohen). Flat frozen sections of the iris. (a) taken from Lemur fulv. (×48, Azanstain). (b) Taken from Rhesus monkey (×85, Azanstain). Pupillary area below. The regular, crossing pattern of the collagen fibers in the iridic stroma can be seen clearly. (Compare with Figure 1). The blood vessels show the same pattern as the iris stroma.


bloodvessel
M. sphincter
a
crypts
Pupillary margin
b

Galagidae. In species of such families, the anterior border layer of the iris is made up of small branched chromatophores with slender processes joining each other to form a kind of "syncytium." Supporting this syncytium is a network of argyrophil fibers covered by a relatively thick, continuous layer of endothelial cells (fig. 4A-a).

The structures of the iris stroma and the the anterior border layer in higher developed monkeys, such as Cebidae, Callithricidae and so forth, differ markedly from those in other species. One of the most impressive features in this evolutionary process is the fact that the regularity of the stroma pattern gradually becomes lost and a division into two distinct layers through an interstitial cleft, the so-called cleft of Fuchs, gradually develops.

In contrast to the structure found in Prosimiae, the anterior border layer in the Simiae is thicker, more dense in its appearance and the pigmentation of this area increases markedly. The previously mentioned division of the anterior from the posterior leaf develops through the gradual enlargement and confluence of interstitial spaces which are filled by ground-substance and a fine argyrophil fiber network. In the entire iris, the amount of homogenous ground-substance within the fiber system is increased.

The pigment cells become more numerous in the anterior border layer than in the posterior leaf. In many families of Simiae, the pigment in the posterior layers is completely absent. The chromatophores in these species are either roundish, isolated cells, spread out over the anterior border layer, or cells with slender processes joining neighboring ones, to form a networklike "syncytium."

Isolated, large clump-cells of Koganei, heavily pigmented, are best demonstrated in Aotes, Saimiri and Erythrocebus (fig. 2-c). Here, the cells are located within the anterior leaf, diffusely spread out over the entire area. In many species of Simiae, the network of pigment cells in the anterior leaf frequently reveals the same even structure as observed in the connective tissue of the stroma in lower monkeys.

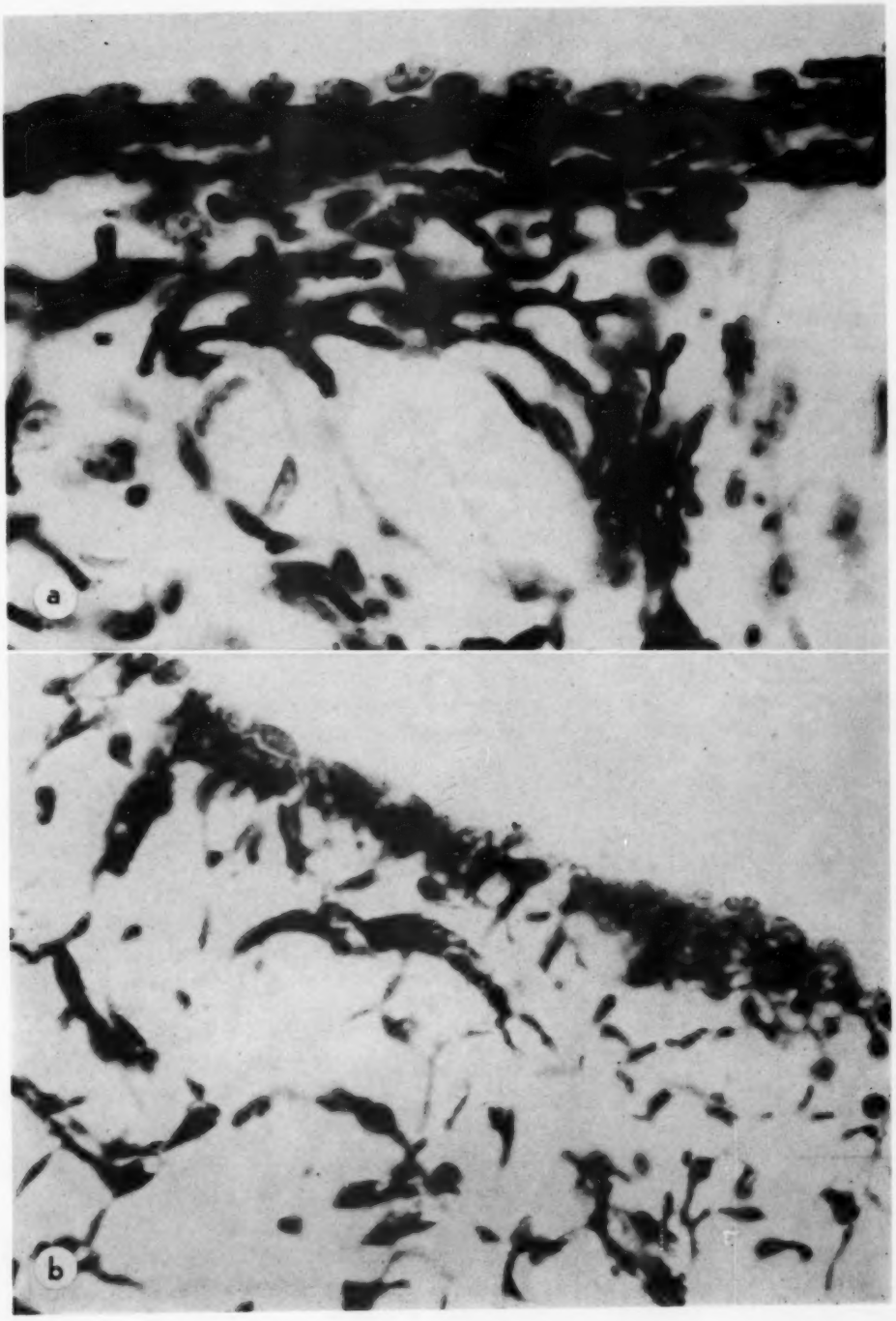
During this evolutionary process, the blood vessels of the iris change in their appearance. Among the Catarrhinae, many species demonstrate the same thick "hyalinized" adventitia found in human eyes. However, this feature may depend upon age, found more pronounced in older animals.

2. The structure of the anterior border layer in primates

In many species of mammals (except rabbits), the anterior border layer is continuously covered by endothelial cells and does not show any openings or defect.[7] Similarly, lower monkeys, such as Tupaia, Lemur, and so forth, were found to have a complete and relatively thick endothelial layer on the anterior surface of the iris (fig. 4A-a). This endothelium which is not pigmented in any way, covers a small layer of pigment cells and collagen and forms, together with them, the so-called anterior border layer. In Prosimiae, the endothelium consistently forms a distinct layer, separating the iris from the anterior chamber (figs. 4A and 4B). It is best seen in Tupaia and some families of Lemur. In Simiae, we find a very differently developed surface structure. As already mentioned, the number of pigment cells within the anterior border layer in Simiae is much greater than in Prosimiae.

The endothelium on the surface does not

Fig. 4A (Roden). The structure of the anterior leaf in the iris of two species of Simiae is demonstrated: (a) Tupaia (×720, Goldner stain). (b) Cebus-monkey (×400, Goldner stain). In Tupaia, the lowest developed primate, the endothelium on the surface border layer of the iris is continuous (a); while in the Cebus-monkey, which belongs to the more highly developed Simiae, the endothelium has partly disappeared (b).


a
b

appear continuous. While in some areas the nonpigmented endothelium is in evidence, in others it is completely absent (figs. 4A and 4B). The rate of reduction of the endothelium varies in different species. In Saimiri, Macacus, Cebus or Erythrocebus, for instance, one occasionally finds large crypts with no endothelium at all; while in other families, such as Ateles, Leontocebus or Papio, only a few areas with tissue reduction were observed. It is of interest to note that even some apes, such as Chimpanzee or Orang-Utan, fail to show large apertures on the anterior border layer. However, reviewing a large collection of various species, we find it quite obvious that they do exist, especially in the Simiae.

A good method to prove the presence of endothelium on the iris surface is perfusion of the anterior chamber with slightly hypotonic solutions. A swelling of endothelial cells will then take place, facilitating the differentiation between areas with and without endothelial lining. In areas where the endothelium is completely or partly lost, heavily pigmented stromal cells are seen. However, among the various species of primates there are great variations in the architecture of the anterior border layer. In some species of Simiae, apertures of the surface endothelium, crypts and even large clefts appear, sometimes very similar to those found in human specimens (figs. 4A and 4B). Large crypts, where the endothelium and the superficial layer of the stroma are absent, are filled with clusters of irregularly arranged, argyrophil fibers and homogenous substances. In my material I did not observe the type of morphologic structure on the iris surface described by Margari in human eyes.

Recently, on the basis of microradiographic investigations, François and co-workers[3] support the assumption of openings in the anterior border layer in human eyes, describing a new canalicular network beside the vascular pattern. The present study confirms the structure of the anterior iris surface but leaves open the question of an interstitial lymphatic system.

3. The iris root in primates

In cross sections, the iris root of primates frequently appears extremely thin (figs. 5A and 5B). In this respect, too, Prosimiae and Simiae are different. However, a high degree of tissue reduction in the iris root seems to be a general characteristic of all primates. In Tupaia, a number of iris processes are present in the region of the chamber angle, connecting the iris root with the cornea and sclera (fig. 5A-a). During the process of evolution, however, a reduction of the pectinate ligament takes place and the entire structure of the chamber angle changes its appearance.

In Simiae, the peripheral tendons of the dilator attached the peripheral iris to the ciliary body instead of the corneosclera; and the connective tissue in the vessels layer of the iris decreases. In my material, this reduction frequently appeared to be so total that no connections at all were left between the iris stroma and the tissue in front of the ciliary muscle (fig. 5B-d). The arrows in Figure 5B-c show clearly how the so-called uveal meshwork of the filtration angle joins the ciliary body to the cornea rather than to the iris. Some species show a complete loss of connective tissue between iris and ciliary body (fig. 5B-d). This probably accounts for

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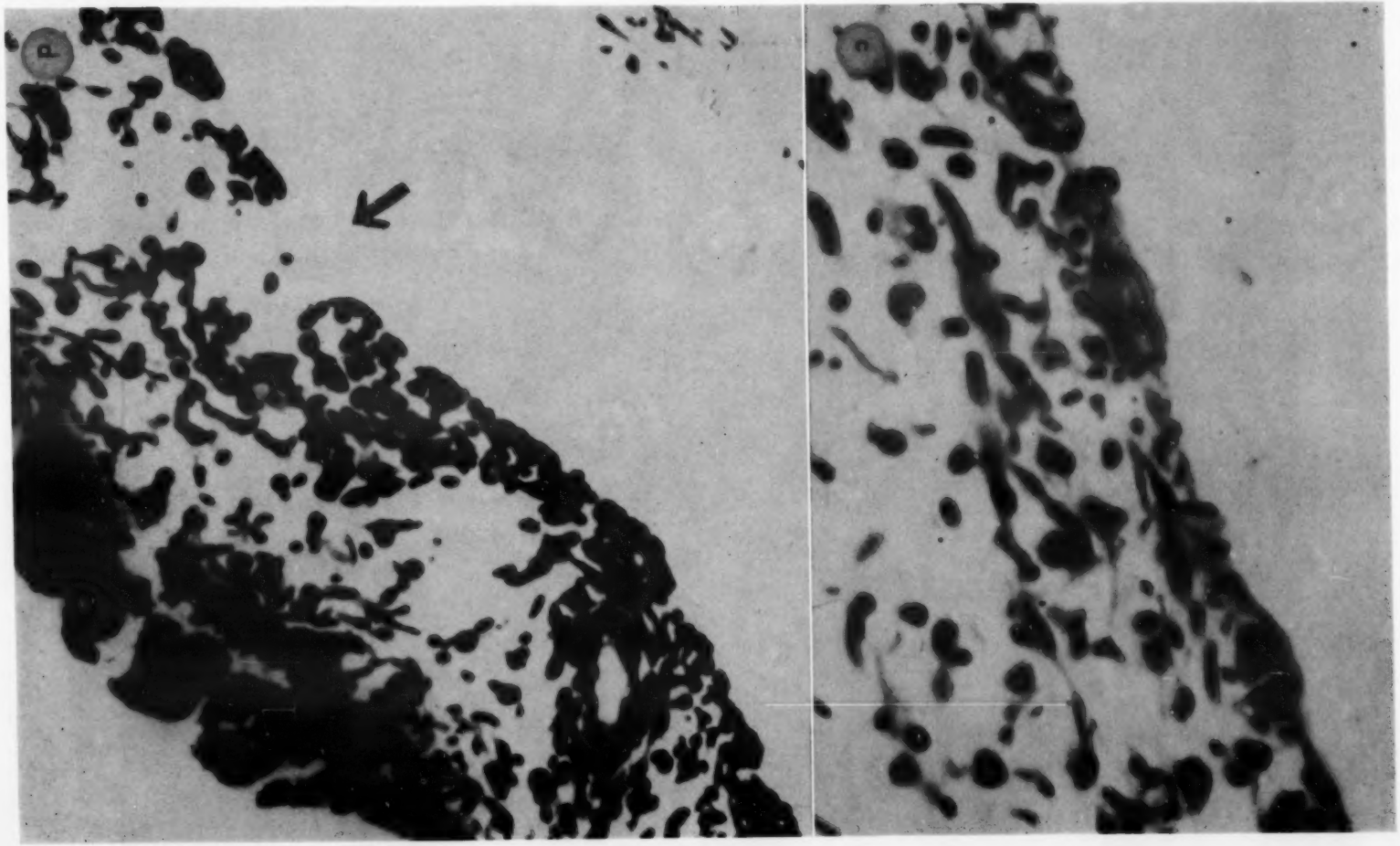
Fig. 4B (Rohen). (c) Erythrocebus (×480, Goldner stain). (d) Hylobates (×260, Goldner stain). In both cases, the endothelium on the anterior border layer is discontinuous and has disappeared almost completely. The iris is covered for the most part by chromatophores. (d) demonstrates a large crypt (see arrow) within the anterior border layer of the iris of Hylobates.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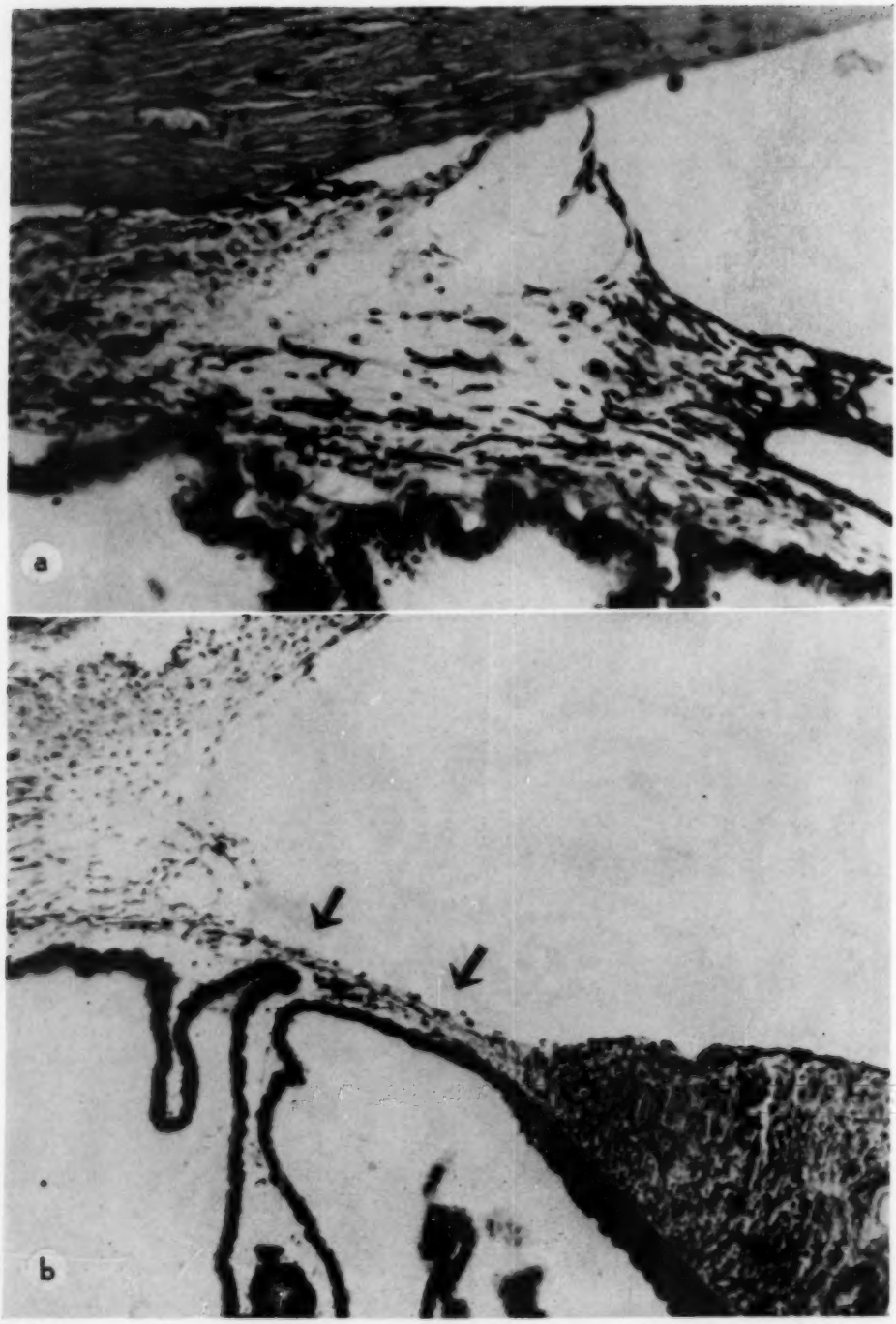
a
b

the complete separation of the iris stroma from other parts of the uvea to the extent that the iris stroma appears to be an organ by itself.

4. Experimental studies and discussion

The functional significance of the peculiar structure described in the anterior border layer is not as yet clear. In order to throw some light on this old problem, perfusion experiments were undertaken. At this time only a few tentative observations can be made. Bárány's method of perfusion was used with slight modification. Dogs, rabbits, rhesus monkeys and human eyes enucleated immediately after death were perfused with dextran solutions of various molecular weights, some with and some without hyaluronidase.

Perfusion of monkey eyes with dextran in vivo or in vitro resulted in a penetration of the particles into the iris, mainly in areas where crypts are located (fig. 6). In areas where the anterior border layer and the endothelium on it are well developed, the perfused substances had a tendency to form into isolated clusters and fasten into the iris surface (fig. 6-c). Thus, my observations confirm the findings of Gregersen[4] with suspensions of killed cocci in human eyes.

The same phenomena were obtained by perfusion or incubation of alpha chymotrypsin in the anterior chamber in concentrations of 1:5,000 or 1:2,000. A dissolution of the stroma surrounding the crypts or clefts was found in several cases, particularly after incubation of the enzyme for two or more hours at body temperature.

When the perfused solution contained hyaluronidase in concentration of 50 to 100 units per ml., penetration of dextran or trypan blue into the iris took place much more rapidly and deeply than in the control specimens, taken from the other eye of the same individual.

Generally speaking, the perfused dyes tended to be concentrated in those areas where crypts or endothelial defects are found. Perfusion studies by François, et al.,[2] showed similar effects in the region of the chamber angle and the iris root, although these authors did not discuss it specifically. Their illustrations show that India ink penetrated more intensively into the iris tissue and the ciliary body whenever the perfused solution contained hyaluronidase.

Summary

In various species of about 30 families of primates the structure of the iris was investigated by histologic and histochemical methods. Attempts were made to trace the evolutionary process of the iris in primates by comparing the iris structure of lower with higher developed species. Marked changes in structure and form of the iris were observed during the evolutionary process.

The iris stroma in lower monkeys was found to consist of collagen fibers which form an even pattern of interlaced fiber bundles crossed at equal angles. This system may serve as the functional mechanism of the pupillary movements. In Simiae, separation between the anterior and posterior border layer and a partial reduction of the endothelium on the surface and channel-like spaces within the iris tissue develop gradually. While in Prosimiae, the main area of pigmentation is found in the posterior portion of the iris; in Simiae, this concentration is in the anterior border layer. Higher monkeys also show a peculiar thickening of the

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Fig. 5A (Rohen). The appearance of the iris root in various families of primates. (a) Tupaia (×140, Goldner stain). Notice the pectinate ligament and the large attachment of the iris to the cornea and the ciliary body. (b) Lemur fulv. (×98, Goldner stain). A wide reduction of the connective tissue on the iris root (arrows) can be seen clearly.

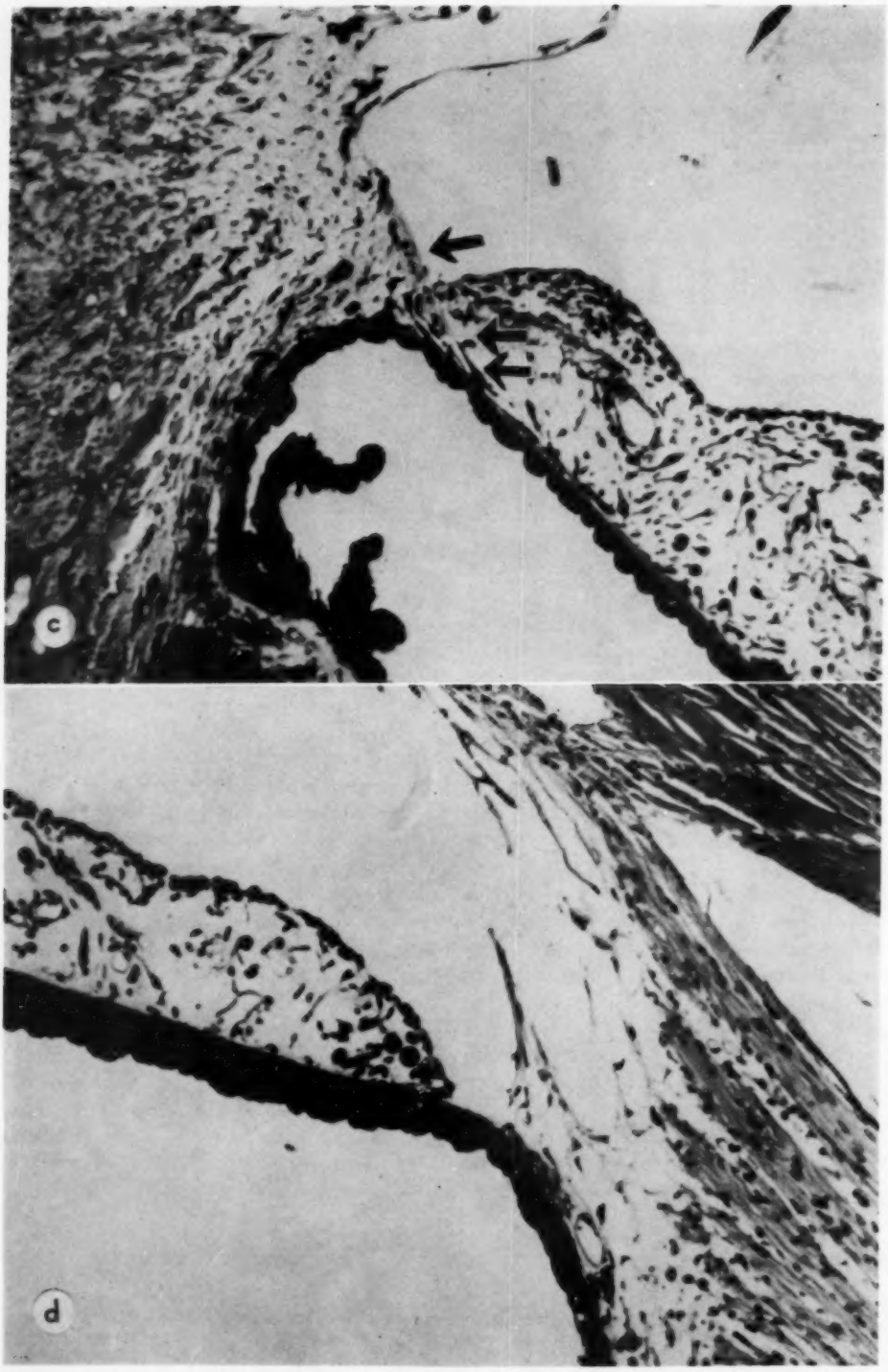

Fig. 5B (Rohen). The appearance of the iris root in various families of primates. (c) Aotes tard. (×98, Goldner stain). Note the clear separation between the collagen fibers of the ciliary body, respectively the uveal meshwork of the chamber angle and the iris stroma (arrow). (d) Oedipomondas (×150, Goldner stain). Notice the complete absence of connective tissue in the region of the iris root. Only the dilatator muscle layer and the pigment epithelium are connected to the ciliary body.

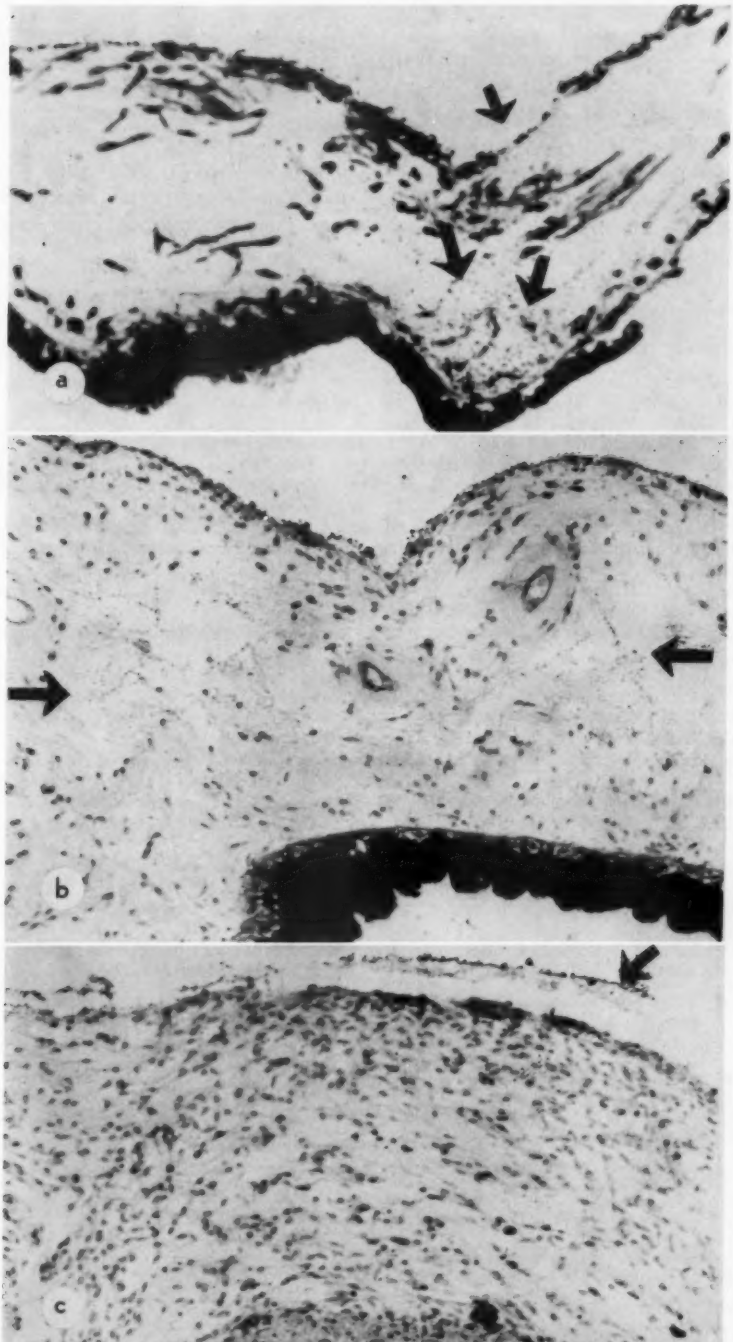

Fig. 6 (Rohen). The appearance of the iris after perfusion of dextran solutions in the anterior chamber. (a) Macacus rhesus (×480, PAS stain). The perfused dextran particles (molecular weight 300,000 to 500,000) are visible within the interstitial stroma spaces, having penetrated through an aperture on the surface (see arrows). (b) and (c) Human eye (60-year-old patient) which was perfused 28 hours after death with dextran for 60 minutes (mol. weight 300,000 to 500,000) (×120, PAS stain). (b) and (c) are taken from the same sections. (b) demonstrates the penetration of the dextran particles into the iris stroma, mainly located within the cleft of Fuchs (see arrow). (c) is taken from an area which showed no penetration. The particles, however, are clustered together on the surface (arrow). No crypts or apertures are found in this area.

adventitia of iris blood vessels with some degree of hyalinization.

An attempt was made to interpret the functional importance of these morphologic findings by some preliminary experimental studies using dextran perfusion into the anterior chamber of human and monkey eyes. It was found that the perfused material tended to penetrate chiefly through the crypts and apertures of the anterior border layer into the iris tissue. This penetration occurs much more rapidly and deeply into the iris tissue when the perfusion fluid contains hyaluronidase.

Anatomisches Institut der Universitaet.

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PRESENT STATUS OF THE A AND V SYNDROMES*

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I. Introduction

The conditions of vertically incomitant horizontal strabismus have created much interest and confusion. They are now popularly known as the A and V syndromes and it is likely that this appellation will persist. Because of the wide range of opinion as to both etiology and therapy, it is felt worthwhile to summarize current concepts regarding them.

While isolated cases have been described in the past, it remained for Urist[1-7] to point out the large incidence of these cases. He was preceded by Urrets-Zavalia[8] who described them in some detail and advised routine examination in the straight upward and downward gazes to identify them. Prior

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to this time, it was considered that examination in the straight upward and downward gazes was of no value since these are fields of no individual muscle function.

Urist has divided these conditions into four groups:

1. Estropia with bilateral elevation in adduction. Deviation greater at near than at far.

2. Esotropia with bilateral depression in adduction. Deviation greater at far than at near.

3. Exotropia with bilateral elevation in adduction. Deviation greater at far than at near.

4. Exotropia with bilateral depression in adduction. Deviation greater at near than at far.

Costenbader[9] applied the more descriptive and graphic terms of A and V. This classification is:

1. V-esotropia. The esotropia is greater below than above.

2. A-esotropia. The esotropia is greater above than below.

3. V-exotropia. The exotropia is greater above than below.

4. A-exotropia. The exotropia is greater below than above.

These correspond respectively to the four groups of Urist but are not necessarily identical as an accompanying vertical component is not implied.

Since it is the normal pattern for exo-deviations to be greater in upward gazes and for eso-deviations to be greater in downward gazes, there must be arbitrary limits established for an imbalance to qualify as being an A or V defect. A group of New York ophthalmologists[10] recommends the following:

1. An exo-deviation must be greater by 15 diopters in the upward gaze than in the direct forward gaze to qualify as a V-exotropia. An exo-deviation must be greater by only 10 diopters in the lower gaze than in the direct forward gaze to qualify as an A-exotropia. Since increased exo in the downward gaze is "against the rule," less is needed here to qualify.

2. An eso-deviation must be greater by 15 diopters in the downward gaze than in the direct forward gaze to qualify as a V-esotropia. An eso-deviation must be greater by only 10 diopters in the upward gaze than in the direct forward gaze to qualify as an A-esotropia. This is for the reason that eso in the upward gaze is "against the rule," therefore less is required.

3. A vertical imbalance as such need not be present, but if one is present, it should be noted whether or not it is bilaterally symmetrical, equal, and in accordance with the theoretical pattern. If it is unilateral, or grossly asymmetrical, or of a type not conforming to a theoretically correct one and in contradiction to theory, this should also be noted.

Certain examination standards must be followed. This same group recommends the following:

1. Measurements to be taken 25-30 degrees from horizontal and *not* in the extreme upward and downward gazes. This is to minimize or eliminate accommodative influences in lower gaze and dissociation type imbalances. The full refractive correction should be worn. Measurements by cover test.

2. The fixation target should be an accommodation symbol of appropriate size rather than the usual fixation light. This is to standardize measurements and to eliminate by control any accommodative element. Accommodation influence could produce a false V-esotropia.

3. Facial bony pattern and shape should be noted, as A, O, or V. This point is of minor importance, having no bearing on therapy and a questionable one on etiology.

4. Measurements to be done both at six and one-third meters and in the lateral diagnostic positions of gaze.

It is admitted that these qualifying "standards" are arbitrary and may be open to criticism. The quantitative amount demanded between forward gaze and either upward or

downward gazes in order to qualify is certainly adequate. There is often a fluctuation in the quantitative measurements of these defects on successive visits. This fact indicates the need for repeated, careful, quantitative measurements.

II. Etiology

The etiology of these conditions is wholly obscure. The causative factor may be mechanical, neurogenic, or both. At present there exist three concepts or schools.

1. Horizontal recti school

This school feels that basically these imbalances are exaggerations of the normal tendency of exo-deviations to increase in upward gazes and of eso-deviations to increase in downward gazes. Thus, a defect greater in upward gaze is said to be due to lateral rectus dysfunction; a V-exo representing overaction and an A-eso an underaction. Defects greater in the downward gaze implicate the medial recti. Thus a V-eso is said to be due to overaction and an A-exo to underaction of the medial recti. Urist is the leading exponent of this school.

2. Vertical muscles school

While some believe both sets of vertical muscles to be implicated,[11] this is not common, and this group is usually divided into two schools or factions, one group believing the obliques to be causative, and the other group believing the vertical recti to be at fault. The abnormality may be manifested through the secondary functions of abduction and adduction of the obliques and vertical recti respectively.

Oblique subschool. This group feels that in defects greater in the upward gaze the inferior obliques are at fault. Thus a V-exo would be due to overacting inferior obliques and an A-eso to underacting inferior obliques (since the obliques abduct). Defects greater in the lower gaze are attributed to superior oblique dysfunction. Thus an A-exo is said to be due to overacting superior obliques and a V-eso to underacting superior obliques (since the obliques abduct). Jampolsky[12, 13] is an exponent of this school.

Vertical recti subschool. This group feels that in defects greater in the upward gaze the superior recti are at fault. Thus a V-exo would be due to underacting superior recti and an A-eso to overacting superior recti (since the recti adduct). Defects greater in the downward gaze are attributed to inferior recti dysfunction. Thus an A-exo is said to be due to underactive inferior recti and a V-eso to overacting inferior recti (since the recti adduct). Brown[14] subscribes to this concept.

3. Combined school

This group has varied ideas regarding etiologies, feeling that the horizontal recti may be at fault in some instances and the vertically acting muscles in others (this is supported by the fact that no demonstrable vertical defect exists in some cases), or there may be a *combined* dysfunction of both horizontally and vertically acting muscles. This is logical, since the defect appears in gazes where both sets of vertically acting muscles are working in combination, as well as the horizontally acting muscles. In other words, a form of synergic dysfunction exists. This is supported by Breinin's[15] electromyographic findings, showing altered firing in the horizontal rectus of the deviating eye alone as gaze shifts in a vertical direction. He subscribes to a combined etiology,[16] as do I. Schlossman[17] also is in this group.

Not only are the muscles unknown through which the defect manifests itself but, as stated, whether it is mechanical, neurogenic, or both is equally unknown. There are other points arguing against a purely mechanical cause in addition to the findings of Breinin. No constant anatomic abnormalities are found at surgery and there is no constant vertical component. Indeed, oftentimes a vertical component may be present opposite to what would theoretically be in order (for

example, bilateral inferior oblique overaction in an A-eso or bilateral superior oblique overaction in a V-eso).

III. Treatment

Treatment of these imbalances is surgical but, since etiology is not established, definitive surgical principles cannot be laid down. The situation is further confused by the fact that each school can show both good results and failures by following its tenets.

1. Horizontal recti school

The lateral recti are attacked if the defect is greatest above. Thus in a V-exo deviation they would be weakened, and in an A-eso deviation they would be strengthened. If the defect is greatest below, the medical recti are attacked. In a V-eso deviation they would be weakened and in an A-exo deviation they would be strengthened.

With these approaches there is a definite risk of over-correction in the field of the least deviation if the field of the greatest deviation is fully corrected—a V-eso deviation can at times be converted to a V-exo deviation with disconcerting ease.

In an effort to minimize this possibility, a second maneuver is often of value, namely, supraplacements or infraplacements of the horizontal recti insertions. These are done in an effort to alter function more in one vertical position than another. Unfortunately, there is some disagreement as to the direction in which the placements should be made. One group will infraplace the medial recti to obtain increased function in the upward gaze while another group will supraplace them for the same purpose. This matter should be studied by controlled experimental surgery, something probably impossible to accomplish.

Knapp[18] has written on this subject at some length. He places the horizontal recti in the direction of the field in which decreased function is desired, and in the opposite direction when increased function is desired. For example, in a V-eso the medial recti would be receded and displaced downward in an effort to lessen adduction more in the downward gaze as compared with the upward; whereas in an A-exo the medial recti would be resected and supraplaced in an effort to obtain increased adduction in the lower gaze as compared with the upward. The amount of the displacement may vary from a few mm. to a full tendon width, approximately nine to 10 mm., depending on the severity of the vertical incomitance and the individual surgeon. We have usually done nine or 10-mm. displacements.

2. Vertical muscles school

A. *Obliques.* Since the secondary function of the obliques is abduction, this factor is used as the basis of the surgical approach of this school. The inferior obliques are attacked when the defect is greatest in the upward gaze. Thus in a V-exo deviation the inferior obliques would be weakened, and in an A-eso deviation they would be strengthened. The superior obliques are utilized if the defect is greatest in the downward gaze. Thus in an A-exo deviation they would be weakened and in V-eso deviation they would be strengthened. The complication of torsion has not been a problem in any of these maneuvers. There is an understandable reluctance on the part of men not subscribing to this school to weaken the superior obliques since they are so important in downward gazes.

B. *Vertical recti.* This school utilizes the secondary function of adduction of the vertical recti as the basis of their surgical approach. The superior recti are attacked when the imbalance is greatest in the upward gaze. Thus in a V-exo deviation the superior recti would be strengthened and in an A-eso deviation they would be weakened. The inferior recti are attacked when the imbalance is greatest in the downward gaze. Thus in an A-exo deviation they would be strengthened and in a V-eso deviation they would be weakened. A reluctance to weaken the inferior recti is just as applicable here as the

reluctance to weaken the superior obliques, and for the same reason.

A second maneuver is available here akin to the supra- and infraplacements of the horizontal recti. It consists of nasal placement of the vertical recti insertions when increased adduction is desired, and temporal placement when decreased adduction (or increased abduction) is desired. There is no dispute here as to the direction in which the placement should be made. The amount of the placement may vary here just as in vertical displacements. The average is about five to seven mm. Miller[19] has used seven-mm. displacements in his series on a purely arbitrary basis. He found this maneuver to be of value in all types except A-exo deviations. In extreme cases, the muscle could be moved midway between its former insertion and the horizontal rectus insertion. This placement may be the sole maneuver used or it may be combined with a resection or a recession, depending on the severity of the defect and the opinion of the individual surgeon. Recessions and resections of the vertical recti demand respect, and they should not be used in a casual manner. Their range of safe surgery is limited.

3. Combined school

Since this group feels the etiology either varies or is a combined horizontal-vertical abnormality, they vary their surgical approach. When there is no accompanying vertical muscle component they follow the practices of the horizontal recti school, usually doing a strengtheneing or weakening procedure combined with a supra- or infraplacement as indicated. In my own practice, I am currently following Knapp's ideas on the direction of the placements.

When there is a clearly demonstrable and symmetrical vertical defect that fits the theoretical pattern, this group will attack the appropriate vertical muscles, be they recti or obliques. But if there is a unilateral, or a severely asymmetrical vertical defect, or one that does not fit the theoretical pattern, this vertical component would be considered coincidental and would be handled by whatever "standard" specific vertical surgery is indicated,[20] while the A or V defect would be approached in accordance with the horizontal recti school concepts.

It has been my experience at times to do the theoretical approach dictated by one or the other of the vertical schools and obtain a partial correction consisting of the elimination of the A or V component, leaving a "standard" type of horizontal imbalance, for which appropriate routine horizontal rectus surgery would then be done.

On purely academic grounds I have not combined horizontal and vertical surgical procedures at the same operation. While this combined attack may at times be indicated, I have felt it to be educationally sterile. In order to learn more about these problems, it is worthwhile to do a two stage procedure at times rather than a combined operation and never know which was the effective one.

When a bilateral vertical component not in accord with the theoretical pattern is operated upon, it does not seem to alter the A or V component, in my experience. For example, if an A-eso deviation has a definite bilateral inferior oblique overaction (contrary to what is expected) and if the obliques are receded, the A-eso does not increase.

In seeming contradiction to this observation, though not necessarily so, is an interesting theoretical approach. It is to increase deliberately the smaller component of the A or V defect in an attempt to equalize it with the larger component and thus convert the turn to a "standard" one. This would then be handled by a "routine" operation. These maneuvers should definitely be done in two stages. This approach could be used if one is reluctant to weaken either the inferior recti or the superior obliques. For example, instead of weakening the superior obliques for an A-exo deviation, one could strengthen the inferior obliques and increase the exodeviation above, hoping thereby to make the

exotropia comitant in the vertical gazes. Then appropriate horizontal surgery could be done. It should be repeated that this is largely a theoretical approach.

Occasional cases will be encountered with an exo-deviation above and an eso-deviation below, or, rarely, vice versa. Obviously the most conservative surgery is in order here. Since the lower gazes are ordinarily the most important in everyday life, this is the field to attack first. Perhaps simple vertical displacement of the indicated horizontal recti would be the most conservative surgical approach and the sole maneuver, with further surgery determined by the result of this procedure. Orthoptics might be of value in some of these quantitatively small cases, depending on the type of the defect.

Breinin has estimated that over 50 operations are available on a theoretical basis for these defects, thus putting them in a class with ptosis. Until the etiology is clarified, all surgery will be experimental. The fact that good results are obtained at times with all the various approaches could indicate a multiple or a combined horizontal-vertical etiology, probably both mechanical and neurologic. A group study is under way in New York in an attempt to clarify this entire subject.

Summary

Present concepts of the etiology and therapy of the A and V syndromes are still confused. In general, these concepts may be divided into three groups, basing their theories of dysfunction on: (1) horizontal recti, (2) vertical muscles, or (3) combined and/or variable. This classification is particularly true with regard to the rationale of the surgical management. Each group reports good and poor results using their approach. The situation demands much more clinical study before the correct answer will be obtained.

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THE PENETRATION OF DARAPRIM (PYRIMETHAMINE) INTO THE MONKEY EYE*

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Pyrimethamine (Daraprim) has been effective in treating acute experimental systemic toxoplasmosis,[1,2] and the work of Ryan[3] and later Perkins[4] suggest that it is of benefit in human ocular disease. Studies by Hogan[5] and Choi[6] on guinea pigs and rabbits raise the possibility, however, that pyrimethamine may not penetrate into the eye in sufficient quantity to be effective. Furthermore, Choi in his analysis of the concentration of pyrimethamine in the serum and ocular tissues of the rabbit,[6] found low concentrations of the drug in the serum, and found that although the drug entered the choroid and the iris, the vitreous and the aqueous contained almost no pyrimethamine.

Subsequent study of the metabolism of pyrimethamine confirms the finding of Hogan that moderate doses of pyrimethamine are not effective in treating uveitis in guinea pigs, but later work by Jacobs, et al.[7] indicates that the reason for this lack of efficacy is that pyrimethamine is poorly absorbed and/or rapidly eliminated by these rodents so that very large doses are required in order to obtain serum or tissue levels comparable to those attained in the human.

Cook and Jacobs[11] have established that pyrimethamine has no effect on Toxoplasma in cell-free fluids, but kills the organisms only when they are intracellular and are multiplying. Wilder, Frenkel, and others[8–10] have shown that the primary site of ocular infection by Toxoplasmas in the human is the retina. It appeared desirable, therefore, to determine whether pyrimethamine enters the retina, the tissue in which it must act to be effective. In addition, since a comparison of the studies of Schmidt[12] and Kaufman[13] indicate that in the monkey, as opposed to many rodents, the metabolism of the drug resembles that of man, it appeared worthwhile to pursue these studies in monkeys.

Pyrimethamine concentrations in tissues of the monkey eye are tabulated in the accompanying tables.

METHODS AND RESULTS

Two Cynemologus monkeys weighing approximately 13 kg. were given 2.5 mg. of pyrimethamine per kilogram intramuscularly, the drug given to one of the monkeys having been radioactively labelled with tritium. Twelve hours after the injection, the animals were killed by exsanguination in order to minimize contamination of the tissues by pyrimethamine in the blood, and the eyes were rapidly enucleated. One eye from each monkey was immediately opened, and with great care the retina was dissected free from choroid and as free from vitreous as possible. In the dissection, care was taken not to include visible vessels or optic nerve. The second eye from the monkey given tritiated Daraprim was bisected, quick frozen in a tube immersed in dry ice and acetone, and sectioned while frozen for autoradiography.

In the analysis of whole retina, some contamination with vitreous occurred. Since vitreous contains approximately 1.1 percent solids[14] and retina about 14 percent solids,[15] the retina was dried and the concentration of pyrimethamine was calculated.† Wet weights of other ocular structures were measured directly. One retina, as well as serum from its donor, was analyzed by the bioassay method employing growth inhibition of Streptococcus

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† If x = wet weight of retina and y = wet weight of vitreous, then $x + y$ = the wet weight as measured and $14\%x + 1.1\%y$ = dry weight as measured. By solving for x the wet weight of retina alone can be calculated.

TABLE 1

AUTORADIOGRAPHY WITH TRITIATED PYRIMETHAMINE

Tissue	Average Counts per Field	$\left(\frac{\text{Counts in Tissue}}{\text{Counts in Blood}}\right)$
Blood	11	1.0
Retina	36	3.3
Sclera	0	0
Iris and Choroid	20	1.8

fecalis as described by Hitchings and previously employed.[13] A second retina, as well as samples of other ocular tissues, from the monkey treated with tritiated pyrimethamine was dissolved in 0.1 N NaOH and extracted into 20 cc. of chloroform which was then evaporated on a planchette and counted in a differential gas-flow counter. Autoradiographs were made from the third eye which was sectioned while frozen by coating the sections with liquid emulsion and incubating for five months at 20°C. Grain counts were made at ×600 with an Ehrlich counting eyepiece.

The results (tables 1, 2 and 3) indicate that although the pyrimethamine concentration in aqueous is about one fourth to one fifth that of serum, and the concentration in vitreous is too low to be measurable, the drug concentration in retina is slightly more than three times that of serum, and the concentration in brain is nearly equal to that of the retina. In the autoradiographs, it was possible to be certain that blood vessels were avoided in the areas counted. The pyrimethamine appeared distributed throughout the retinal cells in a generally uniform pattern and were concentrated there.

DISCUSSION

The data presented indicate that pyrimethamine can reach appreciable concentrations in the retina, the tissue in which it must act to be effective in the therapy of the retinochoroiditis caused by toxoplasmosis. In the monkey whose studies are tabulated in Table 2, the serum concentration after this single dose of pyrimethamine

TABLE 2

RADIOISOTOPE DETERMINATIONS WITH TRITIATED PYRIMETHAMINE

Tissue	Concentration (μg./cc.)	$\left(\frac{\text{Concentration in Tissue}}{\text{Concentration in Blood}}\right)$
Serum	1.02	—
Brain	3.02	3.0
Retina	3.20	3.1
Vitreous	0	0
Aqueous	0.03	0.03

was 1.02 μg. per cc. as compared to the 2.5 μg. per cc. that is generally attained in humans on a pyrimethamine dosage of 50 mg. a day.[13] Despite this lower serum concentration, the pyrimethamine concentration in the retina was 3.2 μg. per cc., well above the 0.25 μg. per cc. level found by Cook to kill Toxoplasmas in monkey kidney tissue culture after four days of drug exposure.[11] Although many other factors may influence the efficacy of pyrimethamine in vivo, these studies do suggest that therapeutic levels of the drug are present in the retina.

In order to investigate fully the distribution of pyrimethamine between blood and retina, more detailed studies are required involving variation of the time of sampling after administration of the drug as well as the dosage of the drug. The work of Schmidt, et al.[12] illustrates that monkey brain maintains a pyrimethamine concentration several times that of serum throughout wide variations in the dosage administered and the time after administration. The fact that the high concentrations of pyrimethamine found in this study in retina are similar to those found by these authors in brain, suggests that the

TABLE 3

BIOSSAY DETERMINATION OF PYRIMETHAMINE

Tissue	Concentration, μg./cc.
Serum	0.32
Retina	1.1
Aqueous	0.06
Vitreous	less than 0.05

Ratio of concentration in retina to concentration in serum = 3.5.

retinalike brain may concentrate pyrimethamine from the blood. This would be consistent with the findings of Jacobs, et al.[7] that pyrimethamine is effective in the therapy of acute experimental anterior and posterior uveitis in rabbits and guinea pigs when serum levels are not high.

The dichotomy between pyrimethamine concentrations in the ocular fluids and ocular tissues may well extend to other drugs. It illustrates that when drugs act on tissues (as do, for example, the steroid hormones) an understanding of the distribution of the drugs in these tissues is of paramont importance. Concentrations of drug in the nearby fluids may not provide sufficient pharmacologic information. In this case, the ability of the tissue of the central nervous system to concentrate pyrimethamine with far greater efficiency than most other tissues may be essential for its therapeutic efficacy.

Summary

Analyses of monkey retinas by radioactive isotope counting techniques, autoradiography, and bioassay techniques indicate that there is an appreciable concentration of pyrimethamine in the retina (the tissue in which it must act in cases of human ocular toxoplasmosis). The amount of pyrimethamine in the ocular fluids is very small, but since the drug is active only when Toxoplasmas are intracellular this appears to be of no importance.

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NOTES, CASES, INSTRUMENTS

RETINOBLASTOMA IN AN ADULT*

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In view of the rarity of its presence in an adult, such a case of retinoblastoma is here presented. The age at which retinoblastoma usually occurs is limited exclusively to the early years of life—a point first stressed by Hirschberg—the average age being two years. The youngest patient recorded was one month of age and the oldest approximately 12 years of age. A true retinoblastoma had been reported by Verhoeff[1] in a patient aged 48 years. In Wintersteiner's[2] series of 429 cases the oldest patient was aged 16 years.

CASE REPORT

K. L., a 45-year-old man was referred from the out-patient department as a case of malignant growth of the left eye on June 2, 1958. He had noticed gradual diminution of vision in the left eye two years ago for which some medicine was prescribed, with no improvement. About five months ago he developed redness in the left eye. He started having dull pain in left eye last December. Swelling in the eyeball, appearing in March, 1958, had gradually been increasing. The growth was increasing slowly but for the last month growth had increased rapidy. A left hemicrania, present for the last 10 days, was severe. The watery discharge was red in color. There was no complaint for the right eye.

Clinical examination. L.E.: Eyeball was pushed outward. The palpebral fissure was wider in comparison to the right. The cornea was touching the outer canthus. It was all hazy. Chemosis of the bulbar conjunctiva was present. A round growth was present in the upper half, from about six mm. from limbus to about two mm. from the inner canthus. In the lower half, a mass with scab formation extended from about six mm. from the limbus to about one mm. from inner canthus. Both these masses were hard to the touch. The bulbar conjunctiva adhered at places to the sclera. The eyeball was stony hard. No ocular movement of the left eye was possible. Vision was no perception of light. No glandular enlargement present.

Vision in the right eye with a +0.25D. Sph. ⊂ +0.5D. cyl. ax. 165° was 6/9. With addition of +1.0D. sph. he could read J1. No disease was apparent in the right eye.

X-ray films of the orbit and skull did not show any abnormalities. Liver and spleen were not enlarged, nor were any nodular masses present. Wassermann and Kahn tests were negative.

The left eyeball was enucleated and the histopathology report (figs. 1 and 2) showed that the tumor consisted of round and oval hyperchromatic cells with scanty cytoplasm. At places these cells showed perivascular growth to form pseudorosettes. At other places the cells were columnar with basal nuclei and arranged in the form of rosettes, the lumen presenting a fine limiting membrane along the inner border of cells. True rosette formation is not a very frequent nor well-developed feature.

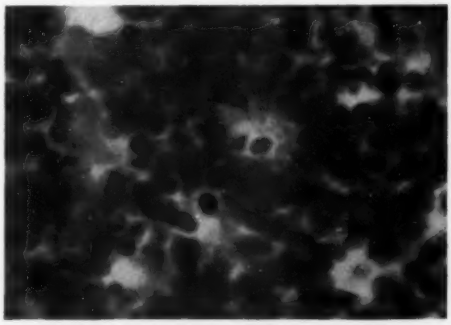

Fig. 1 (Mehra and Hamid). Section showing true rosette formation. Hematoxylin-eosin, ×600.)

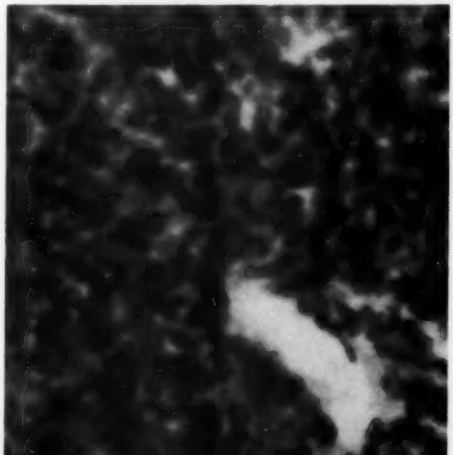

Fig. 2 (Mehra and Hamid). Section showing sheets of tumor cells around a blood vessel. (Hematoxylin-eosin, ×600.)

* From the Gandhi Eye Hospital.

The tumor mass was very vascular, showing areas of hemorrhage and necrosis. The choroid was invaded at two places. The sclera, for the most part, was free except near the limbus where the growth had extended outward. The iris was completely free of tumor cells. The ciliary body had been invaded at the root. The optic nerve was not discernible. The pathologic picture was consistent with retinoblastoma.

Gandhi Eye Hospital.

ACKNOWLEDGMENT

We are grateful to the chief medical officer for permission to publish this report.

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A MODIFIED EUTHYSCOPE

BRUNO S. PRIESTLEY, M.D.
New York

The main difference between the methods of Bangerter and Cüppers is that, while Cüppers shelters the macula carefully with the black dot of the euthyscope, Bangerter stimulates the fovea directly with a slender beam of intense illumination.

Fig. 1 (Priestley). Flickering device.

The recent addition of Bangerter's pleoptophor in our Pleoptic Department at the New York Eye and Ear Infirmary has convinced me that there is merit in Bangerter's idea of direct stimulation of the macula, which can be applied even to children too young to comprehend to the after-image method.

When Bangerter started his Pleoptics School in 1947, among the few initial instruments he described was an ordinary ophthalmoscope in which he had put a hole through the red-free filter in order to localize the point of eccentric fixation. From this idea stems the visuscope, certainly a better and more precise instrument. Bangerter's original idea was recently brought to full fruition in a paper of von Noorden who gave de-

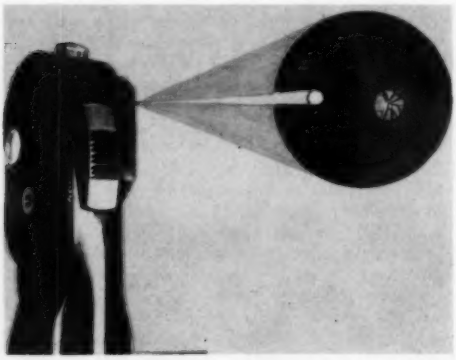

FIG. 2 (Priestley). Eyeground illuminated by the modified euthyscope.

tailed instructions how to modify an ordinary ophthalmoscope for the study of eccentric fixation.

It occurred to me that the same simple device could be used for therapeutic purposes provided the ophthalmoscope has: (1) powerful illumination, (2) a device to turn the light on and off, either at command or rythmically.

A one mm. hole was drilled in the red-free filter of a euthyscope. A flasher was introduced between the plug of the transformer and the socket to cause a thin pencil of light to hit the fovea at a rate of about 100 times a minute* (fig. 1). A half-minute exposure is the average dose. The red-free filter will allow proper localization of the fovea (fig. 2).

57 West 57th Street (19).

ADDENDUM

Recently it came to my attention that G. Krause has proposed a similar, but not identical, modification of the euthyscope (Klin. Monatsbl. f. Augenh., **130**:617-628, 1957).

* Those who own a light interval regulator of Cüppers can connect it to the transformer of the modified euthyscope and thus regulate at will the periods of darkness and light.

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A LID FIXATION FORCEPS*

JOSEPH AMDUR, M.D.
Miami, Florida

In an effort to provide better lid margin immobilization, a lid fixation forceps has been designed. The instrument (figs. 1 and 2) enables the surgeon to hold and lock with one hand by applying pressure. One-half mm. teeth on the grasping surface prevent the forceps from sliding, yet do not lacerate skin or conjunctiva. The forceps is angulated 115 degrees so that the hand on the instrument does not interfere with the view of the surgical field. The grasping foot of the instrument is large enough to immobilize half of the lid, and yet is small enough to be applied to the corners of the lids (for example, lateral tarsorrhaphy). It can be applied with equal facility to the upper or lower lid.

* From the Ophthalmic Plastic Surgery Clinic, Jackson Memorial Hospital. This instrument is manufactured by Storz Instrument Company, Saint Louis, Missouri. I am grateful for the help and encouragement of Drs. Wendell L. Hughes and Alston Callahan.

Fig. 1 (Amdur). Side view of forceps.

Although the trend is away from margin splitting, there are a number of surgical procedures involving the lid margin. In each the problem of immobilization of the lid margin during the surgery must be solved. Examples are (1) excision of small marginal lid lesions; (2) construction of intermarginal lid adhesions (fig. 3); (3) splitting the gray line in the construction of sliding skin flaps along the lid margin (for example Kuhnt-Szymanowski procedure); (4) dissection of the canaliculus prior to its mobilization, and

Fig. 2 (Amdur). Top view of forceps.

Fig. 3 (Amdur). Illustrating the immobilization of the lower lid during construction of intermarginal lid adhesions.

(5) at various steps during the Wheeler-halving procedure and Hughes' tarsoconjunctival flap repair. In the office the forceps is useful during electrolysis of lash bulbs.

3392 Coral Way.

SWELLING OF THE EYELIDS*

In malignant lymphoma and varicella

Report of a case

Thomas J. Kirby, Jr., M.D.

and

James M. Sorenson, M.D.

Rochester, Minnesota

The causes of swelling of the eyelids are many. The commonest cause is edema, whether inflammatory or noninflammatory. Edema of the eyelids is not a disease entity but is a sign of many pathologic conditions. Trauma, local inflammation of the lids, nasolacrimal apparatus, globe, orbit or sinuses can produce edema of the eyelids. Tumors of the orbit or adjacent sinuses, infections, allergic, vasomotor and thyroid or parasitic disease, all can produce edema of the eyelids and orbits.

We wish to report a case in which swelling of the eyelids and orbits was a primary sign of a malignant lymphoma. The incident should serve to remind the ophthalmologist that edema in these sites may be only the localized sign of a serious general or systemic disease.

In the case reported, the diagnosis of a fulminating malignant process of childhood was considered by the ophthalmologist.

Report of case

A boy, aged five years, was referred to the Section of Ophthalmology of the Mayo Clinic on January 12, 1960, because of bilateral swelling of the eyelids. The child had manifested a cough and anorexia on December 23, 1959, three weeks before admission. There was no fever. Four days later the upper eyelid began to swell and a typical varicelliform rash developed. A diagnosis of "chickenpox" was made. The boy was afebrile, nontoxic and playful during the course of the chickenpox but the lids remained swollen. On January 3rd, the lower lids also became swollen.

Because of the persistent swelling of the eyelids, the family physician examined the urine and found it normal. On January 4th, the temperature of the child increased to 100.2°F., and he vomited and in general seemed ill. On January 8th, he was hospitalized, and at that time urinalysis disclosed albuminuria in grade 1+, and the value for hemoglobin was 65 percent (approximately 10 gm. per 100 cc.) of blood. After four days the child was referred to the Mayo Clinic because of the subacute illness and the edema of the eyelids and orbits.

At the time of the patient's admission to the clinic on January 12, 1960, the vision and ocular fundi were normal. Swelling of the upper and lower eyelids was graded as between two and three. The skin of the eyelids was tense. The conjunctiva was not injected or chemotic. Proptosis was present, but it was not remarkable in comparison to the generalized orbital swelling. There was limitation of gaze in all directions, and the limitation seemed mechanical rather than paralytic. The palpebral portion of each lacrimal gland was palpable. A less definable mass could be palpated in the upper and inner portion of the right orbit.

The boy appeared to be chronically ill; he was pale and thin. The oral temperature was 99.8°F. Cervical, axillary, epitrochlear and inguinal lymphadenopathy was noted. A firm, nontender, nodular mass was palpable across the upper part of the abdomen. The mass was indistinguishable from the liver and spleen. Albuminuria of grade 2 was reported; the sedimentation rate was 105 mm. in one hour (Westergren method). The value for hemoglobin was 9.0 gm. per 100 cc. of blood, and erythrocytes numbered 4,670,000 and leukocytes 21,900 per c. mm. of blood, 34.5 percent being lymphocytes,

* From the Section of Ophthalmology of the Mayo Clinic and Mayo Foundation.

15 percent monocytes, 32.5 percent neutrophils, six percent eosinophils and one percent basophils. The platelet count was 120,000 per c. mm. of blood. A blood smear showed rouleau formation of grade 2, with some basophilic stippling and polychromasia.

Examination of a specimen of bone marrow showed a cellular, normoblastic marrow with marked increase in stem cells, most of which were vacuolated. There were some vacuolated lymphoid cells. Leukoblasts were numerous. The marrow was reported as representing acute leukemia, type undetermined. Lymphosarcoma could not be excluded.

An inguinal node was removed for biopsy and was reported as containing a malignant small-cell neoplasm, probably malignant lymphoma (lymphoblastic type). Chemotherapy was advised and the child was referred back to his local physician. He was treated with 50 mg. of 6-mercaptopurine (purinethol) daily. The patient died on March 11, 1960. Postmortem examination performed elsewhere was reported as showing Hodgkin's disease with infiltration of abdominal and thoracic lymph nodes, heart, lungs, liver, pancreas, kidneys, thymus gland and spleen. Unfortunately, tissue from the orbit was not obtained.

Comment

Lymphosarcoma in childhood is not common but, in respect to the incidence of other malignant processes of childhood, the occurrence of lymphosarcoma is considerable. Dargeon[1] reported 43 instances of lymphosarcoma in a series of 583 malignant tumors of childhood (7.4 percent). In Charache's[2] review of 1,800 cases of malignant diseases of childhood the incidence of lymphosarcoma was 6.3 per cent.

Ophthalmologists should remember that orbital neoplasms of childhood often are highly malignant and fulminating. The possibility of malignant disease affecting the reticulo-endothelial system should be considered in orbital disease in childhood.

No tissue appears to be immune from involvement by lymphosarcoma.[3] The tumor process extends much more widely than is clinically demonstrated; this is particularly true of intra-abdominal and retroperitoneal structures.

From the ocular standpoint, Reese[4] lists the following locations of 62 lymphomas with ocular manifestations: orbit, 23; conjunctiva, 21; eyelids and lacrimal gland, 15; iris, ciliary body and choroid, three.

A common causation for both varicella and herpes zoster has been postulated or accepted for many years. An association between herpes zoster and lymphoma or Hodgkin's disease also has been reported and discussed. Blank and Rake[5] suggested that among appropriate age groups, cancer or leukemia should be considered if herpes zoster is present. De Moragas and Kierland[6] reported an associated diagnosis of lymphoma in 39 instances (4.2 percent) in a total of 916 cases of herpes zoster. Bichel[7] reported 240 cases of Hodgkin's disease in which herpes zoster occurred in 11 patients and varicella in two patients (5.4 percent).

The significance of the association between (1) herpes zoster and varicella and (2) malignant lymphoma is not completely understood or clarified. In the cases reported by Bichel, the herpes zoster or varicella occurred rather late in the disease. This suggests that herpes zoster or varicella may occur as a concomitant disease during a state of lowered resistance.

However, other investigators seriously consider viruses as the etiologic agent in malignant lymphoma.[8]

In the case which we have reported the edema of the eyelids and varicella occurred almost simultaneously. There is reason for the speculation that malignant lymphoma of a magnitude sufficient to produce swelling of the orbits and eyelids could have existed for some time prior to the recorded onset. Our case does not clarify the association, but does record the occurrence of varicella in a child, rather than herpes zoster, as one would expect in an older patient. The coincidence of onset suggests that further investigation of the association is warranted.

The significance of the association could accommodate any of several possibilities.

First, varicella or herpes zoster may occur as a superimposed viral disease in a patient whose resistance is low as a result of malignant lymphoma.

Second, either or both diseases may be set off by some other unknown environmental

element, such as drugs or modern chemicals. Ophthalmologists are quite aware of the adverse or exciting effect of the indiscriminate administration of steroids and antibiotics upon herpes simplex. Hence this possible explanation cannot be ignored.

Third, malignant lymphoma may have the same viral causation as varicella or herpes zoster.

SUMMARY

A case of malignant lymphoma in childhood, with swelling of the orbits and eyelids as the presenting sign, is reported. The co-existence of varicella and malignant lymphoma is noted. The possible significance of the co-existence is discussed. Finally, the case is a reminder to ophthalmologists that swelling of the eyelids is not always a localized process but can be a sign of serious systemic disease.

Mayo Clinic.

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INFANTILE AMAUROTIC FAMILY IDIOCY*

IN AN INDIAN CHILD

A. D. GROVER, M.S.
Aligarh, India

Infantile amaurotic family idiocy or Tay-Sachs disease is characterized by lack of mental development, progressive weakness of all muscles of the body, rapidly developing blindness and typical changes in the macula. The symptoms begin to appear during the first year of life, usually about the fifth month, and death occurs before the beginning of the third year with dementia and marasmus. The essential pathologic changes are in the ganglion cells and are due to accumulation therein of lipoids and prelipoids. The infantile form of amaurotic family idiocy with rare exceptions is confined to the Jewish race but this is not true of the late infantile and juvenile forms (Duke-Elder).

The case described here is of interest as it occurred in an Indian Muslim child.

* From the Institute of Ophthalmology, Muslim University.

CASE REPORT

Mansoor, Muslim, a boy, aged one year and four months was brought on November 5, 1959, with the complaints of gradual diminution of vision and general debility since the age of six months.

Family history. The parents, first cousins, had been married for five years. The patient was the first child; full-term, normal delivery; weight 6.5 lb. There was no relevant history in the family.

Personal history. The child had normal growth till the age of six months; he could hold his head and even could sit with slight support. After this the child started losing interest in his surroundings and gradually became weaker. During the last four months there had been tonic contractions of the

limbs and frequent bouts of hiccough. The child used to laugh and cry without any provocation but did not respond to gestures. Eyes showed jerkey movements and did not fix or see any thing for the last four months.

Examination. The patient was a weak child with marked atrophy of the muscles of the limbs, especially the upper. There was slight spasticity of the limbs and attempted movements excited tonic contractions. The reflexes were exaggerated. He could neither sit nor hold his head. There was retraction of the head (fig. 1).

The eyes showed cou. se nystagmoid movements; the pupils reacted very sluggishly. Fixation to a spot of light was absent. There was no other abnormality of the external eye.

The fundus appearance was similar in both eyes. The optic disk was pale, especially on the temporal side; the margins were distinct and the blood vessels had a normal appearance. In the macular area there was a circumscribed white circular spot of about two prism diopters surrounding the fovea which appeared as a small reddish brown oval spot similar to a cherry red spot. The rest of the fundus was normal.

Investigations. All hematologic investigations and serologic tests were negative. X-ray films of the skull showed no abnormality.

Follow-up. The general condition of the child deteriorated. He became dull and apathetic and died at the age of one year eight months after a mild attack of fever.

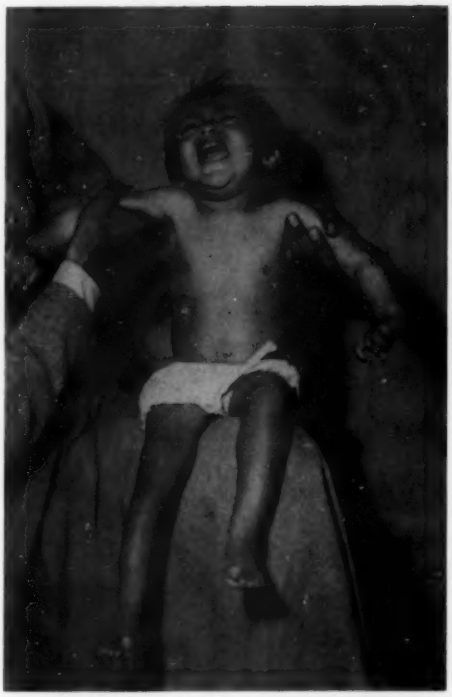

Fig. 1 (Grover). Note the atrophy of the muscles and retraction of the head.

Discussion

Tay-Sachs disease (infantile amaurotic family idiocy) has a distinct familial tendency but usually there is no history of a similar disorder in previous generations (Duke-Elder); however, exceptions occur. Both Falkenheim, (1901) and Goldfeder (1927) published one family pedigree in which the disease occurred in four branches (cited by Elwyn, 1947).

Cordes and Horner reported two cases in Japanese children whose parents were first cousins. In reviewing the literature they collected 14 cases reported in non-Jewish children. In Cockayne and Attlee's patient and in Levy's patient the parents were first cousins of pure English descent. In Cohen's case of an Italian child the grandparents were first cousins. Van Starck reported three German sisters whose parents were distantly related.

In recent years, cases of Tay-Sachs disease have also been reported from India (Manchanda, et al., 1957. Mathur and Srivastava, 1958).

The mode of inheritance of the disease is not clear. According to Franceschetti the cases reported in the literature seem to favor a dominant mode of heredity but, in view of the occurrence of parental consanguinity, the recessive mode of inheritance cannot be ruled out.

In the case herein reported, the clinical picture and the course of the disease were so characteristic that there could be no doubt about the diagnosis. The parents of the child were Indian Muslims and were first cousins. All cases reported from India occurred in male children.

Institute of Ophthalmology.

Acknowledgment

I am grateful to Prof. B. R. Shukla, director of the Institute, and to Dr. Mohan Lal, chief medical officer, Gandhi Eye Hospital, for permitting publication of this case.

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INTRAOCULAR LYMPHOSARCOMA*

Report of a case showing extraocular extension along the perforating scleral canals

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Lymphomatous tumors are found in local or generalized forms in the human body. The involvement of the blood stream is not rare. Lymphoid tissue is not present in the orbit and in the eyeball, for this reason the lymphoid tumors in the eyeball are seen very rarely. Reese[1] collected seven cases from the literature up to 1951, and added four cases of his own.

Cooper and Riker[2] suggest that, in a serious uveitis of unknown origin, which does not respond to treatment, lymphoid tumor be considered if it shows nodular iritis and retinal hemorrhage. In lymphoid tumors the change in blood picture can be seen in advanced stages. All lymphoid tumors are radiosensitive.

Maxwell[3] explains that lymphoid tumors can gradually involve the neighboring tissues in cases not treated early.

Case report

Mr. H. H., a shoemaker aged 60 years, for 11 months showed a tumoral mass under the right upper lid for which he came to the out-patient department on August 26, 1958. Neither his own nor family history is important.

Ocular examination. Under the conjunctiva a pinkish mass about six mm. in diameter was seen near the limbus at the 10-o'clock meridian. There

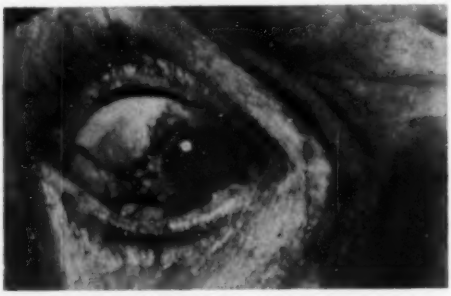

Fig. 1 (Erbakan). Note the dilated capillaries at the lower half of the mass.

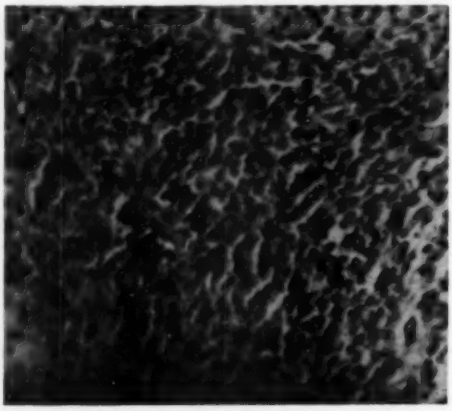

Fig. 2 (Erbakan). Histologic section of subconjunctival mass showed lymphosarcoma.

* From the Eye Clinic of Medical Faculty University of Ege.

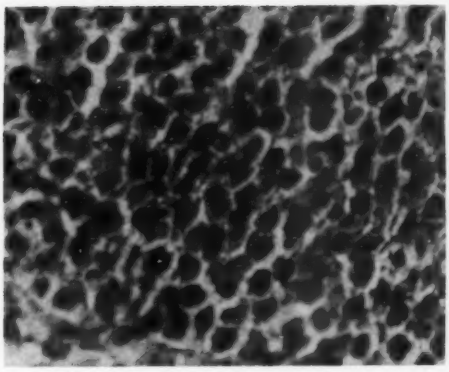

Fig. 3 (Erbakan). Histologic section from the enucleated eye.

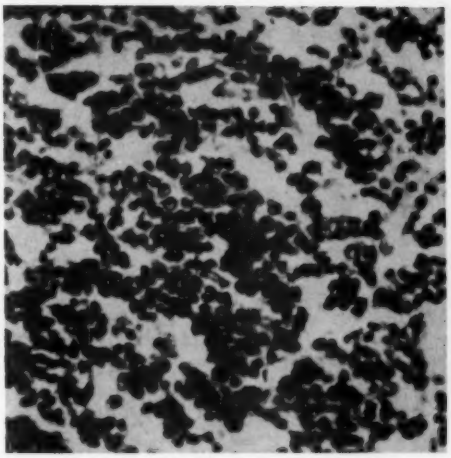

Fig. 4 (Erbakan). Another section from the enucleated eye.

were dilated capillaries at the lower half of this mass (fig. 1). Cornea, anterior chamber and iris were normal. The fundus could not be seen. The pupillary area was lighted under scleral transillumination. Intraocular pressure in this blind eye was 52 mm. Hg (Schiøtz). The subconjunctival mass was removed and sectioned for pathologic examination. Histologic examination showed a lymphosarcoma (fig. 2).

Craniography and X-ray examinations of the skeleton, orbit and optic foramen showed no pathologic signs. No pathologic findings could be found in the clinical and laboratory examinations.

The patient was advised to have X-ray therapy. Later, because of secondary glaucoma, enucleation was advised. It was done on November 12, 1958, and the eye was examined pathologically. The diagnosis was lymphosarcoma (figs. 3 and 4).

Comment

In this case both intraocular and conjunctival lymphosarcoma was present. The rare intraocular lymphosarcoma showed extraocular extension along the perforating scleral canals. No report of an intraocular lymphosarcoma extending extraocularly along the perforating scleral canals could be found in the available literature.

University of Ege.

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IMPROVED CUTTING EDGE FOR EYE INSTRUMENTS

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Pittsburgh, Pennsylvania

The Cutco Cutlery Division of Wear-Ever Aluminum, Inc., a wholly owned subsidiary of the Aluminum Company of America, early last year introduced a superior cutting-edge-knife known as the "Double D." This new edge combined a concave grind with a new bevel grind which increased the cutting area of the knife.

In an attempt to adapt this principle to the cutting edge of eye instruments I wish to introduce cataract, keratome and discission knives that embody these principles. I have found these instruments to be superior to those available today.

The cutting edge on these instruments is

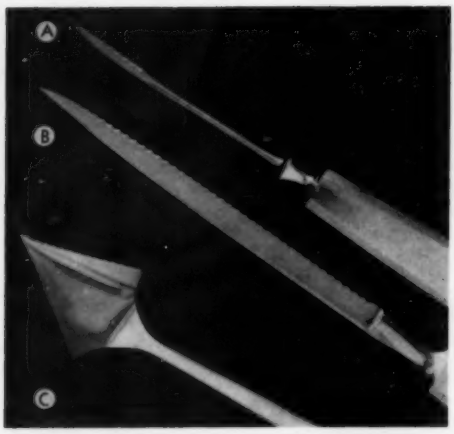

FIG. 1 (McCaslin). Eye instruments with improved cutting edge.

increased by 20 percent, resulting in a shorter stroke and better control of direction in the cataract knife. Keratome sections are performed with less pressure and a minimal amount of trauma. The decrease in drag makes the discission knife extremely superior to the conventional knife; so much so that fewer scissor bisections are now necessary. A discission knife of less than seven mm. has so few serrations that it does not perform well.

These instruments with this new edge are available through Storz Instrument Company of Saint Louis. Resharpening service is available from the same company.

Eye and Ear Hospital (13).

TRACTION SUTURE DEFLECTOR*

FOR MUSCLE SURGERY*

WALTER G. NEEB, M.D.
Detroit, Michigan

A metal bar is suspended across the opening of the eye drape in a vertical direction and metal clips are used to secure the device to the drape above and below.

The limbal traction suture may then be supported over the deflecting bar, thus permitting the suture to clear the cornea and avoid any possibility of abrasion. Adjustment of the relative location of the vertical deflecting bar with respect to the underlying cornea facilitates clearance over the cornea. A hemostat is used to secure the free ends of the suture to the drapes. The direction of the pull on the suture controls the direction of ocular rotation.

The instrument is particularly helpful in recession of the medial recti in which no nasal bridge is present to use to elevate the line of traction. It also simplifies traction nasally and frees the surgeon from constantly watching the assistant.

16840 East Warren Avenue (24).

* Manufactured by the Storz Instrument Company, Saint Louis, Missouri.

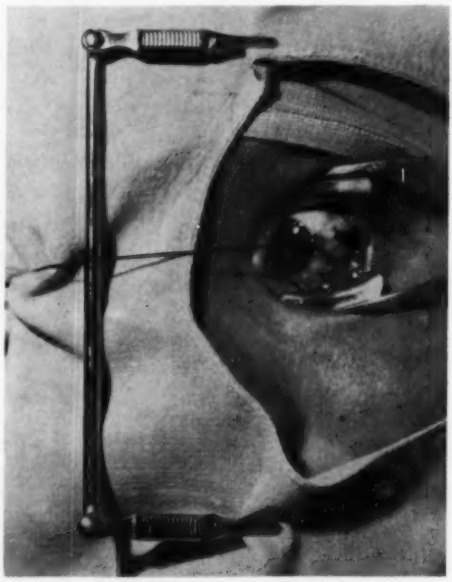

Fig. 1 (Neeb). Traction suture deflector.

AMERICAN JOURNAL OF OPHTHALMOLOGY

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Address original papers, other scientific communications including correspondence, also books for review to *Dr. Derrick Vail, 700 North Michigan Avenue, Chicago 11, Illinois;* Society Proceedings to *Mrs. Katherine F. Chalkley, Lake Geneva, Wisconsin.* Manuscripts should be *original copies,* typed in *double space,* with wide margins.

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Author's proofs should be corrected and returned within forty-eight hours to the *Manuscript Editor, Mrs. Katherine F. Chalkley, Lake Geneva, Wisconsin.* Fifty reprints of each article will be supplied to the author without charge. Additional reprints may be obtained from the printer, George Banta Company, Inc., Curtis Reed Plaza, Menasha, Wisconsin, if ordered at the time proofs are returned. But reprints to contain colored plates must be ordered when the article is accepted.

MID-YEAR MEETINGS 1961

The 97th annual meeting of the American Ophthalmological Society was held at The Homestead, Hot Springs, Virginia, on May 29th, 30th and 31st, with 161 members and guests registered. Despite the flurries of snow that met those who arrived early the weather was kind, the expected hospitality of The Homestead was unchanged and the scientific program was excellent. Edwin B. Dunphy presided with skill.

There were 19 papers presented and, as is nearly traditional with the A.O.S., most tended to have largely a clinical emphasis. The discussions which followed, by physicians with an extensive, varied clinical and teaching experience were, as always, outstanding.

The first Frederick H. Verhoeff Lecture was launched on a high note of excellence by Arthur J. Bedell who discussed angioid streaks and illustrated the condition with a large series of colored slides. He paid a moving tribute to Verhoeff, the first and most outstanding ophthalmic pathologist in the United States whose influence is now extending to the third and fourth generation of his ophthalmic children's children.

The papers which appeared to excite the most interest were:

Reese and Jones who spoke on hematomas under the retinal pigment epithelium and emphasized the value of repeated observation in distinguishing the lesion from malignant melanoma. Sullivan indicated that routine measurement of the peripheral visual field was of value in detecting retinoschisis.

Chandler described pupillary block in aphakia, a condition frequently associated with a flat anterior chamber or iritis following cataract surgery. John M. McLean, in the discussion, pointed out the value of using a sterile applanation tonometer in the early postoperative period to distinguish between a flat anterior chamber due to a wound leak in which the tension was low and that associated with secondary glaucoma in which the pressure was elevated.

Ripps, Breinin and Baum studied the accommodation in the cat and indicated that the administration of a sympatheticomimetic agent such as Neosynephrine prevented the development of cysts of the pupillary pigment margin when anticholinesterase agents were used in the management of accommodative esotropia. Day and Carroll described the occurrence of papillitis, papilledema, and retrobulbar neuritis in 10 patients with thyroid disease of sufficient severity to affect the extraocular muscles. Cordes and Rucker presented a cheerful, well-illustrated history of the American Board of Ophthalmology. Vail, noting the increasing specialism within ophthalmology, described an opsimathic use of the ophthalmoscope for omphaloscopy.

The Howe Medal, the highest award of the American Ophthalmological Society, was presented by the chairman of the committee and a former recipient, Francis Heed Adler, to Frederick C. Cordes for his contributions to the ophthalmic literature, his clarity and eminence as a teacher, the quality of his leadership in ophthalmology, and the creation of an outstanding institute.

Francis Heed Adler was elected president to succeed Edwin B. Dunphy; Paul A. Chandler was elected to succeed Adler as vice president, Joseph A. C. Wadsworth and M. Randolph Elliott were re-elected secretary and editor respectively. Bruce Fralick was named to the council. The next meeting will be held at The Homestead May 28, 29, 30, 1962.

The joint meeting of the Association for Research in Ophthalmology and the Section on Ophthalmology of the American Medical Association in New York, June 25th to 29th, provided a nearly overwhelming series of reports. Under the chairmanship of V. Everett Kinsey, the first-day program of the Association for Research was devoted to 12 reports dealing with ocular chemistry, ocular motility, intraocular pressure and aqueous flow. Much of the material was highly technical, and rare indeed was the ophthalmologist or scientist who had the training and interest to appreciate each of the presentations.

George K. Smelser was the recipient of the Proctor Medal. His Proctor Medal oration suggested many new areas of study as he demonstrated, among other things, the brilliant clarity of some elasmobranch fishes' corneas which do not swell in hypotonic solutions. His talk was followed by a symposium on the cornea, moderated by John E. Harris. The symposium was unusually well arranged and, although much of the material presented was not new, it served to delineate the present position of our knowledge.

At the awards banquet of the Association for Research, Ludwig von Sallmann, paid a high tribute to his old friend and laboratory neighbor, George Smelser. Smelser described the need for bringing basic scientists into

the ophthalmology laboratory and described some of the factors which limited their willingness to leave their basic laboratories.

Mildred Wiesenfeld, the dynamic, charming executive director of the National Council to Combat Blindness, made the Fight for Sight award for the best paper to be presented at a sectional meeting during the year. Her comments were both touching and inspirational and made research in blinding diseases seem the most important work any ophthalmologist could do.

She presented the first annual award of $500.00 for the most significant paper read at a section meeting to Sjoerd L. Bonting for the paper, "The rhodopsin cycle in the developing vertebrate retina," by Bonting, Peter Gouras and Mr. Leo L. Caravaggio. It was read at the Eastern Section meeting. A similar award will be presented annually to the paper judged to be most significant of those presented at the June and the midwinter meetings of the Association for Research.

At the annual business meeting, Samuel J. Kimura was named secretary to succeed Monte G. Holland, who has received a Markle Foundation award. George K. Smelser was named trustee. Hereafter, the main scientific program of the Research Association will be the midwinter meeting, to be held usually in the home city of the chairman of the Board of Trustees. It will be held this year, December 3rd through 6th in Detroit, Michigan.

The meeting of the Section on Ophthalmology of the American Medical Association was so crowded that, after many could not find seats at the first session, it was necessary to move to more adequate quarters in the Grand Ballroom of the Plaza Hotel. Under the leadership of Chairman W. Banks Anderson 19 papers were read. The chairman's address concerned midcentury adjustments in ophthalmology and dealt with the social and economic problems arising from the remarkable increase in ophthalmic research combined with an increasingly larger population. The paper of Raymond A. Allen and Bradley R. Straatsma on "Ocular manifestations of leukemia and allied disorders" won the award of the Section of $250.00 for the paper judged best on the basis of originality and presentation. They did histologic studies of the eyes of 78 patients dying with leukemia and found that infiltration and hemorrhage were limited largely to acute instances of the disease.

At the annual business meeting, Peter C. Kronfeld was elected to succeed W. Banks Anderson as chairman of the Section. Harold H. Joy succeeded Gordon M. Bruce as vice chairman. Joseph S. Haas was elected to succeed Frank W. Newell as representative to the scientific exhibit. Ralph O. Rychener and W. Howard Morrison were re-elected as delegate and alternate delegate. Competent, energetic Henry F. Allen continues as secretary. The next meeting will be in Chicago, with the exhibits at the McCormick Exposition Hall at 23rd Street and the Lake, June 24 through 29, 1962. Future meetings are scheduled as follows: Atlantic City, June 17-21, 1963; San Francisco, June 22-26, 1964; and New York City, June 21-25, 1965.

The Herman Knapp medal, which has been awarded only 11 times since Clifford B. Walker was the first recipient in 1914, was fittingly awarded to W. Morton Grant for his paper, "Clinical measurements of aqueous outflow," which was presented before the Section in 1951. Algernon B. Reese, who has contributed so much to American medicine through his clear writing, forceful speaking and unstinting devotion to ophthalmology, was named recipient of the Prize Medal in Ophthalmology.

The scientific exhibits were richly rewarded, with the Eye Section receiving more than 10 percent of the awards, although presenting less than four percent of the exhibits. The Silver Hektoen Medal presented for exhibits of original investigation, and judged on the basis of originality and excellence of presentation, was awarded to Toichiro Kuwabara, Daniel Toussaint, and David G. Cogan, the Howe Laboratory of Ophthalmology, Harvard University Medical School,

Boston, for the exhibit, "Retinal vascular patterns." This exhibit also received the Section prize of $250.00.

A Certificate of Merit was awarded to Charles D. Dukes, Hilda H. Fox, and Louis J. Girard, Baylor University College of Medicine, Houston, Texas, for the exhibit "In vitro reactivity of human ocular tissues to pharmacological agents."

Honorable mention was awarded to Raymond A. Allen and Bradley R. Straatsma, University of California Medical Center, Los Angeles, for the exhibit "Lattice degeneration of the retina."

A Certificate of Merit was awarded to Wendell D. Gingrich and Mary E. Pinkerton, University of Texas Medical School, Galveston, Texas, for their work on medical photography in the exhibit "Ocular fungus infections."

A Certificate of Merit was awarded to James F. Burch, Jr., Manhattan Eye, Ear and Throat Hospital, New York City, for his work on medical illustration in the exhibit "Roentgen diagnosis of blowout fractures of the orbit."

The scientific program of the Section on Surgery rejected the official slate of officers and elected a chairman from the floor. They then adopted a resolution sponsoring an American Board of Abdominal Surgery and called upon the House of Delegates to recognize the new Board. No action was taken when no one appeared before the reference committee to defend the resolution.

The House of Delegates approved an increase in American Medical Association dues to $35 in 1962 and $45 in 1963. They voted that the employment of the referring physician as a surgeon's assistant is contrary to ethical principals if done for the purpose of dividing insurance benefits, and established a seven-man commission to consider problems arising from the care of patients by paramedical personnel.

Frank W. Newell.

THE 1961 OXFORD OPHTHALMOLOGICAL CONGRESS

The annual meeting of the Oxford Congress, its 46th, was held in Oxford, England, from July 10th to 12th, under the able mastership of A. B. Nutt, F.R.C.S., of Sheffield. As usual, it was a superb experience. More than 300 members and guests, from all parts of the world, attended. The program was excellent; the arrangements, thoroughly planned and prepared, for more than adequate. In spite of the increased attendance, the genial air of informality and companionship, so characteristic of past meetings, was fully maintained.

The beautiful college of Balliol was the headquarters and its Hall the scene of central social festivities. The scientific sessions and exhibits and the commercial exhibitions of fine British ophthalmic equipment were held in the University Laboratory of Physiology and its adjacent grounds.

Many members left their wives behind or put them elsewhere in order to recall the days of their youth and live in Residence, each with his own soap and towel to join the bathing parade each morning, "starting from the Porter's Lodge at 7:30 for Parson's Pleasure." The Residents were informed that "the gates will close each night at 12 p.m. and those Resident members who wish to stay out later should notify the night porter of their intention." So far as I know, there was no climbing over the walls after midnight, nor were any members disgracefully involved with the bedels of the University.

The golfing members, who wear a special tie (green, orange and blue diagonal stripes) enjoyed a tournament, the results of which unfortunately were not a part of the agenda, so the ophthalmic world will ever remain in ignorance regarding its outcome.

At the opening session, the past Master, O. M. Duthie of Manchester, most gracefully inducted the new Master, A. B. Nutt, and invested him with the beautiful chain of office, worn in the past by many distinguished men

of British ophthalmology. Mr. Nutt, in his inaugural address, graciously paid tribute to these and warmly welcomed the members and guests. Following this was the announcement of the election of two new Honorary Members of the Congress, Sir Henry (Shikapur) Holland of England, and Derrick Vail of Chicago, the latter being particularly deeply stirred by this great honor so generously bestowed.

The members of the International Council of Ophthalmology, who had held a meeting in Oxford a few days before, were the guests of the Congress and enjoyed the front row of advantage.

The scientific program opened with a discussion of "Trachoma and allied infections." The first paper traced the development of our knowledge of this disease from earliest time to the present and was delivered by Sir Stewart Duke-Elder in his customary superb style so that it was a literary gem. He gave good arguments revealing the part that trachoma has played in the cultural, historical and economic development of man and finished with the thrilling story of the isolation of the virus and great promise of a successful vaccine as the direct result of the isolation.

Mr. Barrie R. Jones of London ably discussed the "Glycogen matrix virus infections in London" and reported on his own observations of the effect of the "Tric" (from trachoma-inclusion blennorrhea) viruses on the mixed population of a large and cosmopolitan modern city. His studies showed the importance of venereal involvement. The third official paper was that by Dr. Leslie H. Collier on "Researches on the prevention of trachoma." We all are aware of the pioneer role Dr. Collier has played in the "proving" of the virus transported from China and are also aware by this time of his great authority in the field of viruses and their vaccines. He demonstrated to us the feasibility of parental immunization against the "tric" viruses and outlined a current investigation along these lines that is occurring in a Gambian village. The future possibilities are obviously of enormous world-wide importance.

The papers were primarily discussed by Mr. M. J. Gilkes of Brighton, who made a most thoughtful plea to use the term 'trachoma" only in the widest clinical sense, and by Prof. G. B. Bietti of Rome, who cited his promising investigations of mass vaccination against the trachoma virus, employing killed vaccine.

Dr. C. Dwight Townes of Louisville, Kentucky, then presented a delightful short history of the successful struggle against trachoma in the mountains of Kentucky in the early part of this century, illustrated by very good black and white photographs of the "horse and buggy" practice of ophthalmology (literally) of those days.

After lunch, Dr. W. J. Holmes of Honolulu, discussed "Leprosy of the eye," illustrated with remarkably good Kodachrome photographs, for which he is becoming noted. He reviewed for us from his vast experience, the changing concepts of prevention and the medical and surgical treatment of the eye diseases produced by the Hansen bacillus.

Prof. H. J. (the ring) Flieringa of Rotterdam, described his "method for surgery in the angle of the anterior chamber of the eye." Briefly, it consists of a semilunar scleral flap dissected toward the cornea from the underlying ciliary body and inclusion of the necessary adjacent corneal-scleral incisions in order to facilitate the exposure of the lesion and its adequate removal. Very neat.

Mr. D. P. Greaves of London told us about "Ophthalmic manifestations of giant-cell arteritis" and pointed out that where vision is affected by occlusive arterial disease, giant-cell arteritis should be considered as a possible cause, even in the absence of a positive biopsy or of a high erythrocytic sedimenation rate. He emphasized the alleviative role of corticosteroid treatment.

The last paper of the first day was by our perennial favorite, Mr. F. A. Williamson-Noble of London, who discussed the confus-

ing problems sometimes involved in the diagnosis of physiologic cupping and presented a neat instrument for the rapid detection of arcuate scotomas.

The second day opened with an animated film presentation by Prof. Leon Coppez of Brussels on "Exploration of binocular vision with the aid of the major amblyoscope." This excellent teaching film remarkably simplified the complex subject of binocular vision (except for the vertical components).

The outstanding event of the program was the contrbution by Mr. A. J. Honour and Dr. R. Ross Russell of Oxford on "Intra-arterial thrombi in response to injury." You know those white spots that are at times seen in the retinal arteries and that are undoubtedly the cause of some cases of amaurosis fugax hitherto considered due to vasospasm? Well, they are due to pieces of agglutinated platelets along with some leukocytes that very rapidly form at the site of injured intimia of arteries and break off as the result of the headlong persistence of the arterial pressure of the circulating blood stream. In a most remarkable film the authors showed this going on before our own eyes, and it is an experience that one can never forget to see the "white substance" break off and zoom along the artery, moving like a flashing neon light advertising sign, to become halted at a bifurcation and then seeming slowly to decide which of the cross-roads to take, finally to disappear in distintegration. On seeing this film, even the clinician who may be most skeptical toward esoteric experimental research, turns away convinced of its value and most grateful for the demonstration of what actually goes on.

The Doyne Memorial Lecture was delivered by famed neurologist, Dr. Macdonald Critchley of London. He spoke on "Inborn reading disorders of central origin: Developmental dyslexia." This was a most timely lecture delivered in the finest tradition of British Medicine, on a subject that has been grossly neglected by the majority of ophthalmologists. This neglect has been due in part to ignorance of the massive importance of the problem, not only to the children of the world but particularly to the poor soul who is thus afflicted. The neglect on our part is also partly due to the confusing terminology and often esoteric ideas that are found in the literature on the subject and also to the fact that there apparently are very few real scientific and common sense brains to be found in many of the workers. Dr. Critchley most nobly set us on the correct line, and would we had more of his kind. This lecture is of the greatest importance to ophthalmologists everywhere and its appearance in print is eagerly awaited.

Following the Lecture, Dr. Critchley was presented with the Doyne Medal amid prolonged applause.

After lunch in the Hall, Dr. R. H. G. Monninger, U.S.A., somewhat informally discussed the "Present status of enzyme therapy in ophthalmology." The comprehensive nature of his subject prevented its lucid elaboration.

Charming Dr. Sheila Kenny and her coauthor, Dr. J. J. Macdougald, of Dublin, gave us a welcome fillip by her presentation of "Treatment of raised intraocular pressure by the use of ganglion-blocking drugs." Her careful report on the use of these drugs in the routine treatment of post-traumatic hyphema and the prevention of secondary glaucoma and blood staining of the cornea gave much food for thought. Her evidence was impressive.

Our own Dr. Edmund B. Spaeth of Philadelphia, who has deservedly won a place in the warm hearts of our British colleagues by his frequent visits, contributions to the Congress, and genial nature, talked on "The surgery of the horizontal defects," illustrated with slides culled from his great experience in this field. It was warmly received.

The final paper of the day was that of Dr. Enrique Malbran of Argentina, on "Classification and results in retinal detachment surgery" (with film). His useful classification of the clinical appearances of reti-

nal detachments will serve as a guide to the type of surgery indicated, at least in the present state of our knowledge.

The program of the meeting of the last day consisted of papers by Dr. H. E. Henkes of Rotterdam, on the "Recording of the EEG of the visual cortex and its application in the ophthalmic clinic," followed by Dr. S. J. H. Miller and Dr. G. Patterson of London on "Hereditary aspects of glaucoma" and closing with a discussion or symposium on "Ocular complications of head injuries," opened by Mr. J. M. Small of Birmingham, Mr. A. A. Jefferson of Sheffield, and Mr. J. S. Graves of Coventry.

The papers were discussed by Mr. M. J. Roper-Hall of Birmingham and others. I deeply regret that circumstances kept me from attending the closing session, and I am unable to give a first-hand report. It will be necessary, therefore, to curb impatience until the appearance in print of these undoubtedly stimulating papers.

I cannot close without describing the social events, so much an intimate and most delightful part of each Congress. They do much toward cementing friendships and the creation of new ones in an international gathering such as this.

In the late afternoon of July 10th, a garden party was held on the lawn of Balliol. The weather was kind and the setting most charming amid the centuries-old towers and copper beeches. The ladies in their best frocks and colorful hats brightened the scene with their presence like a conversation piece of English art. It was a most memorable party, particularly for the Americans present to whom such an experience is a novelty. Following this, Mr. and Mrs. J. P. Francis Lloyd generously gave hospitality to all the members and their families, entertaining them at their beautiful estate near Oxford. Ah! The lovely English turf, trees and flowers!

The evening of July 11th was devoted to the annual banquet held in the historic Hall of Balliol, graced with the presence of the Master of Balliol. Since all members and guests could not be accommodated in the Hall, there was a marquee extension on the adjacent lawn, where on a closed-circuit television the events taking place in the Hall were projected. The dinner and wines were most excellent. J. H. Doggart proposed the toast to the Oxford Ophthalmological Congress in classic English, exquisitely fluent. The Master responded in no less gracious and witty terms. L. E. Werner of Dublin, eloquently and with Irish wit proposed the toast to the guests, to which responded Dr. Macdonald Critchley, the new Doyne medalist, and Prof. G. B. Bietti of Rome, both of them polished speakers.

Each year, the Oxford Ophthalmological Congress gets bigger and better. How it is permitted to maintain its standard of homely and friendly charm, in spite of rapidly growing numbers, is a mystery indeed—until one has observed the master hand of the most efficient secretary I have ever seen, Ian Fraser of Shrewsbury. He acts most skillfully, usually behind the scenes, working for the success and welfare of the organization every minute of the time.

At the risk of increasing his burden of the handling of this exploding membership, I am compelled to say that each American ophthalmologist should attend the Oxford Ophthalmological Congress at least once in his life and enjoy the fruits of its aura and the excellent scientific fare that is always available. Next year, the Doyne Lecturer will be H. B. Stallard, ophthalmic surgeon of world renown, and a most happy choice.

Derrick Vail, E.A.*

INTERNATIONAL COUNCIL OF OPHTHALMOLOGY

A meeting of the International Council of Ophthalmology was held in Balliol College, Oxford, on Saturday, July 8th.

There were present: Duke-Elder (president), Hartmann (secretary), Streiff (treas-

* Means—Enthusiastic anglophile.

urer), Arruga, Lyle, Melanowski, MacDonald, Müller, Palomino Dena, Paufique, Uyemura, Vail, Weve.

Ex officio. Bietti (president, International Association for the Prevention of Blindness) Franceschetti (president, International Organization against Trachoma), Valdéavellano (president, Pan-American Association of Ophthalmology), François (secretary, European Society of Ophthalmology), Coppez (president of last Congress), Sen (president of next Congress), Copper (secretary for *Index Ophthalmologicus*).

The following is a summary of the more important matters discussed:

1. Two new members were welcomed to the Council—Valdéavellano, in his capacity of president of the Pan-American Association in place of Payne, and Vail (U.S.A.) who had been elected by the Council to replace Espildora Luque who had resigned.

2. The gift of a president's badge to be worn by the president on official occasions was made by Lady Duggan in memory of her husband, Sir J. Duggan, a late member of Council; this was accepted with acclamation.

3. It was agreed that the sum of S.Fr. 5,000 should be made available to help subsidize the expenses for the XIX International Congress in Delhi of young people who were not in private practice and who were making a contribution to the proceedings of the Congress. Applications should be submitted before November 30, 1961, to the secretary of the Council, Dr. Edward Hartmann (2 Avenue Ingres, Paris, XVIe). It was also agreed that the sum of $200.00 (U.S. dollars) should be given to the International Association for the Prevention of Blindness for the publication of the *Journal of Social Ophthalmology*.

4. The Gonin Medal was awarded to Goldmann (Berne), to be presented at the Congress in Delhi in 1962.

5. International Congress in New Delhi, 1962. Applications for accommodations in Delhi for the XIX International Congress in December, 1962, must be submitted (and paid for) before January 31, 1962.

6. A list of the ophthalmological societies affiliated to the Federation, together with the name of the president and the name and address of the secretary, will be published in the *Acta* of the XIX Congress, in view of the fact that no *Index* is to be published at that time.

7. An international classification of ocular diseases, prepared by Mme. Schappert-Kimmijser with certain Dutch collaborators, was introduced by François. Consideration of this report was delegated to a subcommittee consisting of François (chairman), Lyle, Bietti and Vail, the committee to report to the next meeting of the council.

8. Interim reports were received from the subcommittees engaged on the standardization of tonometers and on the making of a clinical case card for glaucoma.

9. The following ophthalmologic societies were admitted into the Federation: the Oxford Ophthalmological Congress, the Irish Ophthalmological Society, the Société de Cochabamba (Bolivia), and the Ophthalmological Society of the Republic of China (Taiwan); the Ophthalmological Society of Yugoslavia was readmitted to the Federation.

10. The next meeting of the Council will be held in New Delhi on December 2, 1962, at 3:00 P.M., in the Vigyan Bhaban (House of Science). Stewart Duke-Elder.

OBITUARY

ROBERT CECIL DAVENPORT (1893-1961)

It is with great regret that we learn of the sudden death of Robert Davenport of London, England, on June 17, 1961. Widely known and deeply beloved by his colleagues in Great Britain and the Commonwealth, he was personally not so well known here, although his name is a familiar one to many. Those of us who served in our Armed

Forces in Great Britain during the last war will recall him with deep affection and particular regard for his work, in our early days, with our blinded service men who were referred to Saint Dunstans, Church Stretton, Shropshire, for rehabilitation. He was fond of us Americans and most generous with his time, consideration and hospitality. A few of us came to know him well and to appreciate the warmth of his friendship and to see through his kind, gentle, retiring and modest nature to the inner man of skill, deep knowledge and firm integrity of purpose.

He was born in Chunking, China, son of a surgeon father of repute. He obtained his preliminary education in Mill Hill School, and his medicine at St. Barthalomews Hospital, London. He served with distinction as a medical officer in the R.A.M.C. through the arduous Mesopotamian campaign in War I. At the end of the war, he returned to St. Barthalomews to serve as house surgeon, ophthalmic house surgeon, demonstrator of physiology and chief assistant to the Ophthalmic Department, at the same time qualifying in the University of London and the Royal College of Surgeons.

In 1922, he went to Moorfields Eye Hospital as clinical assistant and won the Moorfields Research Scholarship. From then until his death, he served the hospital in one capacity or another, finally as honorary consultant (1956).

His greatest service to ophthalmology was in his activity as dean of the Medical School, first at Moorfields and subsequently at the Institute of Ophthalmology, Judd Street, London (1948-1959). He played an important role in the amalgamation of the Royal London (Moorfields), the Royal Westminster and the Central London Ophthalmic Hospitals to form the new Moorfields Eye Hospital, and in the founding of the Institute of Ophthalmology.

He was president of the Ophthalmological Society of the United Kingdom (1958-1960), the Section of Ophthalmology of the Royal Society of Medicine (1955-1957) and was on the Council of the Faculty of Ophthalmologists from its inception in 1948.

Fortunate indeed were the students in ophthalmology from all parts of the world who had him as their Dean. He looked after their interests, helped them in their loneliness and troubles and treated them as his brothers and sons. It is said that, on the occasion of his retirement from the office of Dean, hundreds of his old students from 63 countries throughout the world spontaneously joined in expressing their affection in the form of a gift and moving letters of appreciation for what he had done for them.

We, his American colleagues who knew him well, will sorely miss him.

Derrick Vail.

CORRESPONDENCE

Correction of aphakia

Editor,
American Journal of Ophthalmology:

I wish to compliment Dr. Robert C. Welsh on his clear and undoubtedly correct explanation of the roving ring scotoma and the jack-in-the-box phenomenon (The American Journal of Ophthalmology, 51:1277 [June] 1961). However, I explain them in a way that to me seems simpler. The roving ring scotoma I explain by the magnification produced by the spectacle lens and the resulting monocular diplopia at its periphery. The diplopia is not recognized as such because one of the images is so greatly blurred. The jack-in-the-box phenomenon I explain by this magnification and the fact that the eye does not rotate on its optical center or anterior nodal point but on a point near the center of the eye. These facts are not specifically mentioned by Dr. Welsh, although they are consistent with his explanations.

(Signed) Frederick H. Verhoeff,
252 Pleasant Street,
Marblehead, Massachusetts.

An aid in minor surgery

How many times does a patient undergoing minor surgery in your office say, "Doctor, this doesn't hurt but that light is too bright."' Or, "Doctor, I would be comfortable if only I could not see what is going on." Because of these laments by anxious or uncomfortable patients I took, upon a patient's suggestion, a contact lens 9.8 mm. in diameter, 43-degrees radius back surface and plano power and sprayed the front surface with a can of black household enamel spray paint. The lens was thus rendered opaque. During minor surgery in the hospital and office procedures, this lens is soaked in Storz solution (1:1000*) along with the instruments and is placed upon the cornea before the illuminating light is fixed upon the cornea. Since the patient's conjunctival sac and cornea have been anesthetized with Tetracaine, there is no sensation and the lens is well tolerated. The lens has an additional advantage of protecting the cornea. It has a disadvantage of occasionally being displaced during surgery and having to be replaced upon the cornea.

(Signed) J. William Rosenthal,
1505 Antonine Street,
New Orleans, Louisana.

Colorado resolution

Editor,
American Journal of Ophthalmology:

Enclosed is a copy of a letter recently forwarded to the executive secretary of the National Medical Foundation For Eye Care. I believe that the letter is quite self-explanatory. As you will note in the letter, these copies are being forwarded to you as a result of a resolution passed by the Colorado Ophthalmological Society instructing me to do so. If you would care to publish the letter in The American Journal of Ophthalmology for whatever help it might provide to other ophthalmological societies by citing our experience, please feel free to do so. It is our feeling that the National Medical Foundation For Eye Care rendered a real service to our society and that whatever can be done to strengthen the effectiveness of that group will be beneficial to all ethical medical eye societies.

(Signed) Max Kaplan, M.D., secretary,
Colorado Ophthalmological Society.

* * *

Mr. James E. Bryan, Executive Secretary
National Medical Foundation For Eye Care
250 West 57th Street
New York 19, New York

Dear Mr. Bryan:

On behalf of the Colorado Ophthalmological Society, I should like to commend and thank the National Medical Foundation For Eye Care for the excellent guidance and assistance which the Foundation recently provided to our Society. As you know, the optometrists of Colorado have recently presented a new bill to the state legislature. The Colorado State Medical Society and the Colorado Ophthalmological Society became actively interested in the proposed bill and sought the assistance of the National Medical Foundation For Eye Care. The help which your organization provided, both in the area of analysis of the proposed bill and in providing material for educational purposes, was very helpful, and played a significant role in the ultimate conclusions and actions of the State Medical Society and the Colorado Ophthalmological Society.

Our experience in this matter has provided evidence that the support and strengthening of the National Medical Foundation For Eye Care are essential to the activities of ethical medical groups and to the protection of the public interest in the entire area of eye care. In order that the medical profession might be made aware of our experience, the Colorado Ophthalmological Society at its last meeting passed a resolution that copies of this letter of commendation and appreciation be forwarded to the editors of the *AMA Archives of Ophthalmology* and The American Journal of Ophthalmology.

(Signed) Max Kaplan, M.D., secretary,
Colorado Ophthalmological Society.

Terminology in operations on iris

Editor,
American Journal of Ophthalmology:

In the February, 1961, issue of The American Journal of Ophthalmology was a paper by Arthur H. Keeney, M.D., on "Classification and surgical techniques in iridectomy" in which he very rightly objects to the incorrect terminology employed

* C.R.I. Germicide (Clay Adams Company).

in ophthalmic texts and papers. He makes a magnificent classification and adds that many authors (except Blaskovics and Kirby) refer incorrectly to the partial iridectomy (that is, of one sector of the iris) performed in the operation for cataract in which a sector of the iris is extirpated, as complete or total iridectomy.

I should like to point out that in 1940 in a paper presented before the II Argentina Congress of Ophthalmology and published on page 119 of the minutes of that meeting, I discussed incorrect terminology employed in referring to operations on the iris and stated the following:

"With regard to the term 'total iridectomy' (in cataract operations), this is wrongly used; nobody has ever performed total iridectomy because this means, in the strict interpretation, extirpation of the whole iris, a thing that is never done. What ought to be said is 'partial iridectomy' of a fragment of the iris which may be the adherent edge or the loose edge."

(Signed) Francisco Paez Allende,
Pellegrini 3090,
Santa Fe, Argentina.

BOOK REVIEWS

POSTOPERATIVE-CATARACT SPECTACLE LENSES. By Robert C. Welsh, M.D. Miami, The Miami Educational Press, Inc., 1961, 123 pages. Price: $15.00.

A needed addition to the ophthalmic literature is this monograph on the optical correction of aphakia. Cataract surgery may be successfully performed but all too often to the chagrin of the surgeon, the patient proves to be most unhappy with his aphakic state. While there has been considerable advance in the designing of correcting spectacle lenses, the author demonstrates that there is still much left to be desired.

Using as a base the editorial appearing in THE AMERICAN JOURNAL OF OPHTHALMOLOGY in 1952 on the "Adjustment to aphakia" which had been written by an eminent anonymous ophthalmologist who therein related his personal observations and experiences, Dr. Welsh has attempted to explain the reasons for the phenomena and to make suggestions which may aid in the prescribing and proper fitting of correcting lenses. He avoids the use of complicated formulas of physiologic optics but much of his text is as valuable to the dispensing optician as to the prescribing ophthalmologist. Certainly much of what he says is controversial but there is a great deal to be learned from his observations and research over a period of years.

Emphasis is placed on the "jack-in-the-box" phenomenon resulting from the "roving scotoma" inherent in strong convex lenses which gives the impression of "no side vision." The author does not favor lenses with a deep base curve but urges his own described type of light-weight lens which he terms the "minimal effective diameter" cataract lens. The faults of various lenses, including aspheric lenses, are described in detail and specific suggestions are made as to the type best suited for various corrections, as well as preferences for aphakics with a round pupil and those with a "keyhole" iridectomy. He feels that round-pupil surgery gives the most satisfactory result, especially when contact lenses are used. The latter are conceded to be the most satisfactory method of aphakic correction and there is some detail as to the types of cataract contact lenses and to the method of fitting.

It is impossible in a brief review to describe in any inclusive manner the various diagrams presented and opinions offered. Those who have a responsibility to the aphakic patient, whether as surgeons, refractionists, or dispensing or laboratory opticians (and especially manufacturing opticians) will have to read the book in its entirety to digest and enjoy the full flavor of this endeavor. Since it does have an important place, it is unfortunate that it has been necessary to charge $15.00 for a work which seems to have been prepared by the offset process rather than by standard printing.

William A. Mann.

FACTORS INFLUENCING VOCATIONAL REHABILITATION OF THE BLIND. By Ellen Reid. New York, American Foundation for the Blind, 1960. 128 pages, 42 tables, bibliography, paperbound. Price: $1.50.

The present status of rehabilitation of the blind is a recent development and has been greatly aided by the inventions of braille, the typewriter, telephone, and tape recorder, as well as the mechanization of industry. In 1943, Congress established the Office of Vocational Rehabilitation, which extended to disabled civilians, including the blind, an opportunity for vocational rehabilitation. Among the 50 states, 37 follow the pattern of separate rehabilitation centers for the blind. These centers teach travel training, skills in daily living activities and trades. This Pennsylvania study reveals clearly that the most important factors for success are health, intelligence, motivation and personality. The basis of most personality problems among the blind stem from rejection, overt or implied, on the part of the parents. Blind children respond well to the same family relationships that are good for sighted children. As the prevailing attitude of society determines rejection on the part of the parents, a friendly, humanitarian outlook on the part of the general public is essential.

James E. Lebensohn.

PRIMARY GLAUCOMA. By Paul Weinstein, M.D. Budapest, Medicina, 1961. 284 pages, 150 figures, 23 tables, extensive bibliography, index.

The name of the author is familiar to the readers of THE JOURNAL not only because he has written many papers but also because he published a monograph in 1953, entitled "Glaucoma: Pathology and therapy." To this work discussing the complex problems of glaucoma and based on about 3000 references, Derrick Vail wrote the preface in which he points out that to find one's way in the enormous mass of published evidence and to distinguish the important from the less relevant is a task not many can cope with. I agree with Dr. Vail in that Dr. Weinstein is a man capable of doing just that.

This ability has made it possible for the author to make available for Hungarian doctors the signficant results achieved in glaucoma research during the past eight years. In his valuable monograph comparable to those written by Sugar, Pietruschka and Leydhecker, we find not only a survey of the evidence published since 1950 but also clear-cut views as to the present state of the glaucoma problem.

The concepts known from the literature on glaucoma: outflow coefficient, angle resistance, tonography, new loading (tolerance) procedures, secretion stop, hemostatic reflex, and so forth are described in detail. There is also a discussion of the new anatomic features (ciliary plexus, aqueous vein, bulbicle of the vorticose veins, mucopolysaccharide content of the angle, gonio-anatomy).

Convincing evidence is presented as to the role of the central nervous system in the control of ocular tension. Intraocular pressure is usually low in cases of cerebral injury and after leukotomy; ocular tension increases in response to the electrical stimulation of certain areas of the diencephalon. In response to darkness the hypophyseal-hypothalmic system produces a substance which increases intraocular pressure. The injection of retrobulbar ganglionic blocking drugs lessens this effect. After iridectomy, destruction takes place in the cells of the ciliary ganglion.

Peter C. Kronfeld wrote the following about the monograph published in English in 1953: "Altogether the book is a valuable, important contribution to the literature which will prove helpful to the clinician as well as the research worker." These words apply in an increased measure to this new book by Prof. Weinstein.

Gyula Lugossy.

THE PERCEPTION OF LIGHT AND COLOR AND THE PHYSIOLOGY OF VISION. By Sir C. V. Raman. Bangalore, India. Memoirs of the Raman Research Institute No. 125. 74 pages, paperbound. Price: Not listed.

Raman has studied the response of the retina to light in different parts of the spectrum by entoptic experiments reminiscent of the Maxwell spot (not mentioned). In daylight illumination a white projection screen was placed about 14 feet from the observer who had his back to the window. When a gelatine film on glass stained lightly with methyl violet was held before the eye for several seconds and then removed, the observer saw on the screen a magnified image of his own fovea as a green disk in the center of which was a bright spot of the same hue, the foveola, set in a less luminous golden-yellow surround. When the dye stuff, lissamine green, was similarly used the fovea and foveola were seen bright yellow, surrounded by a rose-red glow. The author interprets such experiments with suitable screens as demonstrating that the retina contains three pigments which function in the blue-violet, green and yellow-red with absorption spectra of 4000-5000 A., 5000-6000 A. and 6000-7000 A. respectively. The visual pigments involved are xanthophyll in the first region, ferroheme in the second region and ferriheme (oxidized ferroheme) in the third region. In normal vision ferroheme and ferriheme co-operate in seeing yellow and orange. In the absence or deficiency of ferriheme protanopia or protanomaly results. On the other hand, an excess of ferriheme over ferroheme produces deuteranopia or deuteranomaly. The complete absence of xanthophyll causes tritanopia.

James E. Lebensohn.

PROCEEDINGS OF THE ALL-INDIA OPHTHALMOLOGICAL SOCIETY. Volume 18. Sessions 1958 and 1959.

The program for 1958 was opened with a symposium on the treatment of glaucoma in which the subject is thoroughly covered in 10 communications. There are also individual discussions of 11 other subjects, an address by Dr. M. Radavanovic, and the presidential address by Dr. V. C. Rambo. In 1959 the session was opened with a symposium on industrial ophthalmology which consists of 11 excellent papers and there were also eight individual communications and a presidential address.

F. H. Haessler.

KYBERNETIK. Volume I, Number 1. Springer-Verlag, Berlin. Jan., 1961. Price: DM 12.80.

This is the first issue of a new journal devoted to the "transmission and processing of information as well as with control processes in both organisms and automata." The whole field of cybernetics was launched by Norbert Wiener in 1948 with the publication of his book, *Cybernetics*. Although this was largely a mathematical approach to the field of automatic control, several chapters dealt with communication in animals. An expanded version of Wiener's thoughts on human communication and control appeared several years later as, *The Human Use of Human Beings*, and the literature on the application of this fascinating science to human physiology has expanded enormously since. This new journal is, among other things, attempting to relate sensory processes of the central nervous system to information handling in other fields and to develop "mathematical models for communication and control processes in organisms."

Unfortunately the majority of the articles in the first issue are in German which limits its usefulness in this country somewhat. Among these are "Information transmission in the nerve cell," "The light-reaction of phycomyces," "Analysis of eye movements in response to electric stimulation," and "Recognition time in reading." The only article in English is from Johns Hopkins on "Letter constraints within words in printed English."

This appears to be a worth-while addition

to the voluminous science literature of today, and should be of intense interest to neuro-ophthalmologists and ocular neurophysiologists.

David Shoch.

PHYSIOLOGICAL RESPONSES TO HOT ENVIRONMENTS. Compiled by R. K. Macpherson, M.D., from reports to the Medical Research Council. London, Her Majesty's Stationery Office, 1960. 323 pages, bibliography. Price: 35s.

The investigations on climatic physiology reported in this monograph covered a seven-year period and should interest all concerned with the practical problems of living and working in hot climates who wish information on the conditions of thermal comfort, physically tolerable levels of warmth and the levels at which efficiency is likely to decline. The research was done at the Royal Naval Tropical Research Unit at Singapore, established for this purpose in 1948, and at the National Hospital for Nervous Diseases in London. Increasing the air temperature, humidity, rate of working or amount of clothing increased the indices of environmental stress. The newcomer to a hot climate is more distressed initially than the established resident but acclimatization rapidly occurs. As it progresses the increase in body temperature and pulse rate decreases and likewise the concentration of sodium chloride in the sweat. The amount of sweat produced is increased at first but with more complete acclimatization adaptation is accomplished with an economy of water loss. The process is probably mediated by adrenal cortical hormones and the indigenous inhabitants do not differ materially from Europeans in their physiological responses.

James E. Lebensohn.

L'ELECTRO-OCULOGRAPHIE. By Viktor Gabersĕk, M.D. Paris, R. Foulon, 1960. 210 pages, 63 figures, 1 color plate, bibliography, paperbound. Price: Not listed.

This monograph reviews in detail the literature on the electro-oculogram and reports the author's own investigations. The recording of eye movements by electro-oculography has scientifically superseded photographic methods. The unrestrained subject is not disturbed by any light focused on his eyes and after the electrodes have been fastened to his temples he soon forgets about them. The galvanometric effects are not due to muscle action currents but arise from the electropotential difference between the cornea and the retina, due to their divergent metabolic rates. The current flows from the cornea to the electronegative retina. With electrodes on each temple and with the eyes turned to the right, the right electrode is nearer to the cornea of the right eye and hence positive, the left electrode is nearer to the retina of the left eye and hence negative. The resulting voltage is closely correlated to the degree of ocular movement and hence the electro-oculogram records faithfully the reading pattern.

By placing electrodes so as to record both the vertical and the horizontal movements of the eyes, the author utilized the electro-oculogram as an objective test for dyschromatopsia. For this purpose, he designed a large sheet with pseudoisochromatic dots containing a central white circle, and the subject is asked to follow with his eyes the sinuous colored line leading from the circle. He finds that the interpretation of the reading pattern is simplified by a graph, "the scopogram," where vertical lines indicate the saccadic movements and horizontal lines the fixation pauses and regressions. He found that the electro-oculogram gave serviceable information not only in reading difficulties but in many neurologic and psychiatric disorders, including cases of hemianopsia, aphasia, internuclear ophthalmoplegia, schizophrenia, general paresis and Korsakoff's syndrome. He holds that in cerebellar disease the reading pattern reflects characteristically the cerebellar symptoms of asynergy, dysmetry and adiodokokinesis.

James E. Lebensohn.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Busse Grawitz, P. **The formation of collagen fibers from leukocytic inflammatory cells.** Arch. f. Ophth. **163**:232-239, 1961.

Following corneal corrosion a perifocal inflammation sets in through metamorphosis of the connective tissue into leukocytes. These are then transformed back into collagenous fibers. The conclusions are drawn from fixed histological sections, theoretical speculations and per exclusionem. (3 figures, 23 references)

Harri H. Markiewitz.

Valu, L. and Kalapos, S. **The argyrophile fibers of the healthy ciliary body.** Arch. f. Ophth. **163**:226-231, 1961.

These reticulum fibers extend from the suprachoroid to the sclera on the one side and the ciliary muscle on the other. The collagen fibers of the trabecular system split into argyrophile fibers, which then enter the ciliary muscle. Formalin fixation and silver impregnation were used. (4 figures, 12 references)

Harri H. Markiewitz.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Appollonio, A., Leonardi, F. and Renna, V. **Effects of phenylephrine hydrochloride of various concentrations, and of adrenaline bitartrate 2 percent in the conjunctival sac, on the retino-cephalic circulation.** Arch. di ottal. **64**:437-459, Nov.-Dec., 1960.

The blood pressure of the retinal vessels was measured by ophthalmoscopy and the use of the Weigelin ophthalmodynamometer. Observations were made on 62 patients before and after topical phenylephrine or epinephrin. Effects of the drops on the retinal blood pressure were not great. In high concentrations such eye drops have been known to produce general systemic effects. These have been considered psychomotor in some cases, but in this series might be attributed to cerebral vaso-constriction.

Phenylephrine eye drops can cause local pain, headache, vertigo, pulsation of eye and head, ischemia of the lower eyelid, and constriction of the retinal vessels. Iritis and necrosis of the conjunctiva have been reported, but did not occur in this series. (4 tables, 20 references)

Paul W. Miles.

Becker, Bernard. **The turnover of iodide in the rabbit eye.** A.M.A. Arch. Ophth. **65**:832-836, June, 1961.

This work suggests a simple method for measuring the rate of aqueous flow. (4 figures, 1 table, 10 references)

Edward U. Murphy.

Becker, Bernard. **The turnover of bromide in the rabbit eye.** A.M.A. Arch. Ophth. **65**:837-839, June, 1961.

No evidence was found of an active accumulation of bromide by ciliary body-iris preparations as it was for iodide. (3 figures, 7 references)

Edward U. Murphy.

Berkow, J. W. and Patz, A. **Histochemistry of the retina. I. Introduction and methods.** A.M.A. Arch. Ophth. **65**:820-827, June, 1961.

Sections of freshly frozen whole eyes were used for the demonstration of dehydrogenase activity in the various layers. (10 figures, 17 references)

Edward U. Murphy.

Berkow, J. W. and Patz, A. **Histochemistry of the retina. II. Use of phenazine methosulfate to demonstrate the succinoxidase system.** A.M.A. Arch. Ophth. **65**:828-831, June, 1961.

This substance was shown in the past to be an electron carrier from succinic dehydrogenase to tetrazolium salts. This work shows it to be of value in demonstrating succinic dehydrogenase in thin sections of fresh frozen retinas. (4 figures, 2 tables, 15 references)

Edward U. Murphy.

Bottini, A. and Belluschi, A. **The effects of hypercapnia retinal arterial pressure.** Ann. d'ocul. **194**:320-327, April, 1961.

The authors investigated what effect the breathing of 5-percent carbon dioxide has on the systemic blood pressure and on the retinal arterial pressure. They eliminated those patients who showed an unusual emotional response to the test. This left them with a group of 43 people who responded well. In this group of individuals with various vascular states there was no perceptible effect of the CO_2 on the systemic arterial pressure. However, in almost every case there was a rise in the retinal arterial pressure during the inhalation of the 5-percent carbon dioxide mixture. The authors feel that this is due to a specific response by the carotid system of vessels and is compatible with the finding previously reported that inhalation of CO_2 increases the blood flow to the eye. (4 tables, 17 references)

David Shoch.

Cole, D. F. **Electrochemical changes associated with the formation of the aqueous humor.** Brit. J. Ophth. **45**:202-217, March, 1961.

If it is granted that the aqueous humor is formed by the active transfer of solutes and solvent from the plasma to the aqueous, it follows that the rates of transfer of the solvent or solute and the steady state composition of the aqueous will depend on the electrochemical potential difference across its boundary with the plasma. Alterations of the electrochemical potential difference should modify the transfer processes from blood to aqueous and, conversely, metabolic inhibitors which affect aqueous humor formation are likely to alter the electrochemical potential difference. The object of this study is to confirm the existence of this electrical phenomena associated with aqueous formation.

The work was done by collecting the aqueous continuously under a pressure of 20 mm. Hg while the drainage channels were blocked and while electrodes were in position in the peripheral circulation and in the posterior chamber of the eye. Various chemicals were introduced into

the peripheral blood circulation, and the effects on aqueous formation are charted. Cole concludes that the blood-aqueous potential difference was directly related to the influx of sodium and water into the aqueous; administration of D.N.P. and strophanthin-G reduced influx rates and potential difference, but both were markedly increased by sodium azide. (28 references) Morris Kaplan.

DeBerardinis, E. and Tieri, O. **The relationship between the lactic acid concentration of the aqueous humor and the plasma.** Ann. d'ocul. **194**:411-421, May, 1961.

The concentration of lactic acid in the aqueous and in the plasma of rabbits was measured by two different methods, one enzymatic and the second colorimetric. With both methods the concentration in the aqueous was less than in the plasma if the samples were not treated, or were treated only with fluoride. However, if the samples were refrigerated immediately after drawing them from the rabbit then the ratio of aqueous to plasma lactic acid was about 1:3. This was true for both the enzymatic and the colorimetric methods. The authors feel that the most accurate method is the enzymatic on refrigerated samples, because this most probably represents the condition in the living animal. (2 tables, 17 references) David Shoch.

Devi, A., Friel, R. and Lerman, S. **The RNA content and the amino acid-RNA incorporating system in the lenses of various species.** A.M.A. Arch. Ophth. **65**: 855-858, June, 1961.

This was studied in nine species and the degree of leucine and valine incorporation was found to be approximately proportional to the concentration of soluble RNA. (2 tables, 2 figures) Edward U. Murphy.

Galin, M. A., Nano, H. D. and Davidson, R. A. **Aqueous and blood urea nitrogen levels after intravenous urea administration.** A.M.A. Arch. Ophth. **65**:805-807, June, 1961.

A comparison of these levels shows that an eye-to-plasma concentration ratio of less than one is sustained at high blood levels of urea. This supports the osmotic explanation for the pressure-lowering effect of urea. (1 figure, 3 tables, 9 references) Edward U. Murphy.

Hähnel, Roland. **The chemical structure of α-crystallin.** Arch. f. Ophth. **163**: 283-302, 1961.

Alpha-crystallin was isolated from bovine lenses and tested for purity. It was analyzed by electrophoretic, hydrolytic and chemical methods to determine the amount and nature of its various amino acids. The results are tabulated. (9 figures, 8 tables, 26 references) Harri H. Markiewitz.

Kuck, John. **The formation of fructose in the ocular lens.** A.M.A. Arch. Ophth. **65**:840-846, June, 1961.

In the rat this parallels the concentration of glucose in the medium in which the lenses are bathed. Sorbitol acts as an intermediate. (1 figure, 9 tables, 23 references) Edward U. Murphy.

Massimeo, A. and Maselli, E. **Experiments on the tolerance of autologous cartilage placed in the suprachoroidal space.** Arch. di ottal. **64**:399-404, Nov.-Dec., 1960.

Cartilage from the ear was placed in the suprachoroidal space of rabbit eyes. The technique resembled the placement of polyethylene tubing for detached retina surgery. The tissue reaction was mild, there was no fat necrosis, but the cartilage was mostly reabsorbed. (2 figures, 1 reference) Paul W. Miles.

Menna, F. **Histochemical evidence of protective action of Solcoseryl on mouse eyes irradiated with X ray.** Arch. di ottal. **64**:423-436, Nov.-Dec., 1960.

A group of mice were treated with various doses of X ray. Some had, in addition, daily intramuscular Solcoseryl, 1 cc. This is a deproteinized extract of calf serum. Histochemical stains for polysaccharide and alkaline esterase showed that the pathologic effects of irradiation were directly proportional to the dosage of X ray. The Solcoseryl had a noticeable protective effect. (16 figures, 52 references) Paul W. Miles.

Paganoni, C. **Considerations on some miotics.** Arch. di ottal. **64**:405-422, Nov.-Dec., 1960.

This is a review of the pharmacology of miotics and glaucoma. (66 references) Paul W. Miles.

Valiere-Vialeix, V., Robin, A. and Chaput, C. **Physiology of tear excretion.** Ann. d'ocul. **194**:328-336, April, 1961.

The authors review the present status of our knowledge about the excretion of tears. They feel that all parts of the eye are involved in this excretory process. Blinking and winking of the lids causes some propulsion of tears across the eye, there is probably a siphon action of the canaliculi, and finally there is probably a pumping action of the tear sac to drive the tears down the nasolacrimal duct. They conclude that no theory is completely satisfactory and probably several mechanisms combine to produce the flow of tears across the eye and down into the nose. (3 references) David Shoch.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

François, J., Verriest, G., François, P. and Asseman, R. **Comparative study of acquired dyschromatopsia associated with different types of heredo-familial optic atrophy.** Ann. d'ocul. **194**:217-235, March, 1961.

Four groups of patients with optic atrophy were examined for their color sense. The largest group were those with Leber's disease. This group tended to show a red-green color blindness. A group of patients with infantile optic atrophy tended to show blue-yellow color blindness. The remaining two groups of patients were those in which other neurologic defects were associated with the optic atrophy, and in both the recessive and dominant types of inheritance in this group, the defect in color vision was variable. The authors conclude that it is not possible to correlate strictly the anatomic site of the lesion with the specific type of color blindness. (7 figures, 35 references) David Shoch.

Snydacker, Daniel. **Annual reviews. Optics and visual physiology.** A.M.A. Arch. Ophth. **65**:859-902, June, 1961.

The literature for 1960 is reviewed. (377 references) Edward U. Murphy.

Zanen, J. **The photochromatic interval in ocular pathology.** Bull. et. mem. Soc. franç. d'opht. **72**:498-529.

The author investigated the chromatic thresholds and their deviations compared with the threshold of absolute luminosity in ophthalmologic and neuro-ophthalmologic abnormalities. The photochromatic interval in normal persons has been evaluated previously by various authors. It is very inconstant in parafoveal and peripheral vision; it is dependent not only on the degree of excentricity of the zone under study but also on adaptation, fatigue, size and intensity of the stimulus, and the period of exposition to the test. The measurement of the foveola, because of its anatomy and physiology, is easier to evaluate and to compare. The author describes his techniques and his findings in normal con-

trols as well as in a series of congenital and acquired dyschromaptopsias among patients with multiple sclerosis, chorioretinitis, Friedreich's ataxia, diabetic retinopathy, quinine poisoning, and optic atrophy. In outlining the photochromatic interval a specific variability in the appearance and the amount of particular anomalies could be established in the different groups of abnormal trichromates. In optic atrophies the chromatic sensitivity was found to be diminished in all wave lengths; the chromatic thresholds were sharply separated from the absolute thresholds. In diseases of the choroid and retina the photochromatic interval occasionally was normal; on the other hand in several subjects it was found to be increased for the whole spectrum as well as for the long waves only. The congenital dyschromatopes have an interval which extends towards infinity, with exception of the long waves. This refers to both the protanopes and deuteranopes. The deuteranopic and protanopic trichomates have the deficit at the green and red, dependent on the particular variety. This fact constitutes the fundamental principle on various theories of specific color receptors and their alternating blocking. This paper must be read in full if one is to really appreciate the delicacy and thoroughness of this complicated study. The results certainly are of considerable interest. (15 figures, 18 references) Alice R. Deutsch.

5
DIAGNOSIS AND THERAPY

Bagolini, B. **Diagnosis and possibility of treatment of the sensory state in concomitant strabismus with instruments of feeble dissociation.** Ann. d'ocul. **194**:236-258, March, 1961.

The author believes that a better evaluation of the sensory state of the strabismic patient can be obtained if dissociation of the two eyes is not too forceful. He therefore employs a pair of striated lenses which cause a spot of light to be seen as a bar. The axis of two such lenses are placed at right angles to each other so that the bar seen with each eye may be easily identified. Cases of suppression, amblyopia and anomalous correspondence may thus be easily identified.

A second instrument which the author feels is of great value is a series of graded density filters. These filters are employed quantitatively to measure the intensity of suppression of the visual field in the squinting eye, and to measure the power of fusion in heterophoria. It may also be used for treatment in eliminating suppression. The author then outlines his treatment of patients with concomitant strabismus, particularly those under the age of ten years. (4 figures, 2 tables, 18 references) David Shoch.

Beiras, A. **An ocular occluder.** Arch. Soc. oftal. hispano.-am. **20**:1202-1206, Nov., 1960.

The author describes an occluder, made of sponge, which fits the orbital margin and permits movement of the lids, exercise of visual function in strabismus, elimination of ocular secretion, and is useful in preventing the loss of contact lenses in the period of adjustment.

Ray K. Daily.

Bonamour, Georges. **Basic conceptions regarding treatment of ocular virus infections.** J. Med. Lyon, **41**:1499-1507, Dec. 5, 1960.

There is no specific therapy for ocular virus infections. However, the author feels that the use of gamma globulin is probably the most suitable antivirus therapy.

Thomas H. F. Chalkley.

Broadfoot, K. D., Gloster, J. and Greaves, D. P. **Photoelectric method of investigating the amount of oxygenation**

of blood in the fundus oculi. Brit. J. Ophth. **45**:161-182, March, 1961.

Since the amount of visual loss occurring in increased intraocular pressure is not always directly proportional to the degree of the increase of the pressure, it must be assumed that some other factor exists which accounts for this loss of vision. With the idea that a change in the blood supply of the nervous tissue of the eye might well be this other factor, the following studies were undertaken. The instrument which can indicate changes in the amount of blood circulating in the choroid and at the same time indicate the state of oxygenation of that blood by alterations in its color, is described in great detail. The apparatus was designed so that lights of three different colors were projected into the eye in continuous rapid succession while the light returning from the eye was received and measured by the cathode of a photoelectric photomultiplier.

The experiments were carried out in vitro in a schematic eye and in vivo in the albino rabbit eye and in the human eye. The trend of the responses in all three was similar and indicated that the color of the blood in ocular circulation was directly affected by carotid occlusion, cervical sympathetic stimulation, changes in intraocular pressure and even by the apnoea induced by deep breathing. (22 charts, 5 references) Morris Kaplan.

Cecio, A. and Menna, F. **Irradiation of the ciliary body and ocular hypertension.** Arch. di ottal. **64**:359-371, Sept.-Oct., 1960.

After X-ray treatment of the human eye for malignancy hypertension of the globe has been reported. Therefore it is suggested that cataract after irradiation might be the result of a secondary cause arising in the ciliary body. Measures taken to protect the lens from clinical irradiation should apply to the ciliary body even more than to the lens itself.

Guinea pigs were treated with 1400 r X-ray irradiation limited to the ciliary body. The ciliary processes showed the greatest change with atrophy and depigmentation. Much of the pigment was found in the angle and in Schlemm's canal. It was concluded that hypertension was due to pigment obstruction. (6 figures, 36 references) Paul W. Miles.

Cecio, A. and Menna, F. **Histological study of irradiated mouse eyes with and without pharmacological protection.** Arch. di ottal. **63**:333-358, Sept.-Oct., 1960.

The authors review the American literature on the effects of irradiation on the eye, and consider the medications suggested to reduce damage. In a well controlled experiment white mice were irradiated and the eyes examined after 24 hours in one group and in another group after five days. Half of the animals received "protection" by daily injections of 1 cc. Solcoseryl, which is a deproteinized blood extract from a calf. This extract had been shown to increase oxidation-reduction activity within animal cells. The irradiation was produced by X-ray, 160 KW, 6 MA, at 40 cm., with 5 mm. aluminum filter, from 20 to 40 minutes.

The results were shown in color microphotographs. There was a "sensible reduction" of both early and late irradiation damage by Solcoseryl. (21 figures, 62 references) Paul W. Miles.

Davidson, S. I. **The eye in dystrophia myotonica with a report on electromyography of the extra-ocular muscles.** Brit. J. Ophth. **45**:183-196, March, 1961.

The myotonia group includes myotonia congenita, dystrophia myotonia and paramyotonia and in all of them characteristic groups of muscles are involved such as those of the face, the sternomastoid muscles, those of the forearm and hand, the extensors of the knee and the dorsiflexors of the foot. The orbicularis muscle is seriously affected in most cases and

this results in infrequent blinking. It has been suggested that bilateral cataract is a part of this disease but this has not been confirmed. Some optic atrophy may also be associated.

Ten patients with dystrophia myotonica were examined by electromyography and a direct relationship between the extent of the ptosis and the amplitude of the action potentials was found. These myographic changes were similar to those found for other muscles in the body and all were found to be abnormal. In one patient with this disease who came to autopsy little histologic change was found in the extra-ocular muscles. (12 figures, 73 references) Morris Kaplan.

Del Rio Gil, and Rutllan, J. **Visual aids. Their practical importance.** Arch. Soc. oftal. hispano-am. **21**:85-109, Feb., 1961.

The literature is reviewed. (8 figures, 43 references). Ray K. Daily.

Gerkowicz, Kazimierz. **Corneal forceps with flat tips.** Klinika Oczna **31**:83-86, 1961.

The author describes a new type of corneal forceps, made of stainless steel, is light and has flat tips. One tip is a slightly curved plate 4 mm. long and at a wide angle to the shaft of the forceps. The other tip is thin and curved and parallel to the plate of the first tip. (4 figures, 5 references) Sylvan Brandon.

Hugonnier, R. and Magnard, P. **The syndrome of visual fatigue in the young.** J. Med. Lyon. **41**:1509-1518, Dec. 5, 1960.

In his summary the author points out that the syndrome of visual fatigue is characterized by a visual disorder occurring during the effort of fixation which is rendered laborious, or even impossible. It is brought about by extrinsic factors, that is, light and nature of an object fixed by general and intrinsic ocular factors. Among the ocular factors, the importance of small refractive disorders and of deficiences of the binocular vision must be underlined. Treatment consists of rectifying the ocular state but should also apply to the extrinsic factors and the general state. Thomas H. F. Chalkley.

Johnson, S. B. **Eye injuries: diagnostic tips in the multiple injury patient.** Am. Surgeon **27**:170-172, March, 1961.

Advice is given on ocular first aid which may be given before the ophthalmologist arrives.

Thomas H. F. Chalkley.

Lehnert, W. and Thieme, W. **The electroretinogram of papilledema.** Arch. f. Ophth. **163**:303-308, 1961.

The electroretinogram of 20 patients with papilledema due to intracranial tumor were compared to 20 normal ones. The differences noted were insufficient to justify utilization of the method in the diagnosis of papilledema. (3 figures, 22 references) Harri H. Markiewitz.

Lukoff, L. and David, H. **Structural changes in lyophilized vitreous tissue.** Arch. f. Ophth. **163**:240-243, 1961.

Electronmicroscopic studies reveal no differences between lyophilized and fresh vitreous tissue of the calf. Lyophilized vitreous thus seems ideal as implant material. (2 figures, 6 references)

Harri H. Markiewitz.

Malbrán, E., Norbis, A. and Turner, M. **Electroretinography and ocular electromyography.** Arch. oftal. Buenos Aires **35**: 357-397, Nov.-Dec., 1960.

This is a good review of the fundamentals of both these important diagnostic tools. In the case of each one a short historic outline is followed by a description of the technique employed. The different types of response found in normal and in pathologic conditions are analyzed

and discussed. In the case of electromyography the authors currently use a coaxial needle electrode. In that of electroretinography, a small silver hook, introduced into the lower fornix and left hanging from the lower lid border (Gurevith), has been given preference over the usual contact glass type of electrode; reference is made to both the classic ERG as described by Karpe and the photopic and scotopic types of ERG evolved by Burian and by Jayle and coworkers (dynamic ERG). (26 figures, 2 tables, 58 references)

A. Urrets-Zavalia, Jr.

Massimeo, A. **Modification of the clinical picture and of the inclusion bodies of Halberstaedter and Prowaczek in trachoma by local application of tetracycline suspension.** Arch. di ottal. **64**:323-331, Sept.-Oct., 1960.

Thirty-three cases of acute trachoma were treated. Some patients were given tetracycline in oil suspension four times daily, while the others had the same, plus a sulfonamide internally. There was no significant difference in the clinical appearance of the eyes as they recovered. The atrophy of the inclusion bodies and the decrease of the inclusion body count appeared to parallel the clinical improvement. (2 tables, 10 references)

Paul W. Miles.

Mis, Marian. **Objective determination of visual acuity based on optokinetic nystagmus.** Klinika Oczna **31**:87-92, 1961.

The author presents an instrument for an objective measurement of visual acuity based on the principle of optokinetic nystagmus. He does not use the drum, but a mirror which makes pendular movements at a constant speed of two per second which stimulate the appearance of pendular nystagmus. The only changeable part of the set-up is the intensity of light which is controlled by a rheostat. Visual acuity was measured on several individuals with the above instrument and with the Snellen chart under changeable conditions of illumination. The results were plotted on a curve, which is presented. (8 figures, 6 references)

Sylvan Brandon.

Moczulo, Josef. **Improvement of instrument for focal illumination.** Klinika Oczna **31**:93-95, 1961.

The author constructed a light to be used for focal illumination of the anterior segment of the eye. It is a pencil light with a 20-diopter lens at its tip. It is attached to a small box containing a transformer for the usual electric current and dry battery for occasions where electric current is not available. (5 figures)

Sylvan Brandon.

Montes Galvez, J. and Fernandez Mancilla, F. **The influence of the normal and pathologic crystalline lens and other structures of the anterior ocular segment on the potential of ocular repose.** Arch. Soc. oftal. hispano-am. **20**:1167-1170, Nov., 1960.

In order to determine the role of the different ocular structures in the genesis of the electro-oculogram and to assess the practical value of this procedure as a functional test of ocular activity, 21 patients were subjected to this examination. In 18 patients with cataract, the potential was increased, and in one it was diminished. In all three patients with aphakia the potential was diminished. In two patients with iridocyclitis it was increased, and in one it was normal. In one patient with keratitis it was increased and in two diminished. The authors advance the following hypothesis: the difference in potential, which converts the globe into a generator of an electric current, is due to the fact that the anterior pole is electropositive and the posterior electronegative. On this basis the authors explain the results of their investigation. (1 figure, 9 references)

Ray K. Daily.

Nicolato, V. **Roentgen therapy in ophthalmology.** Arch. di ottal. **64**:291-332, Sept.-Oct., 1960.

This monograph begins with an excellent description of the physical and biological properties of the X ray, and ends with practical advice on treatment. The recent refinements designed to avoid damage to the lens are emphasized.

The X ray was recommended for chronic blepharitis, but not for allergies of the eyelids because of the increased susceptibility to cataract in allergic persons. X-ray therapy was recommended for keratitis and pterygium, but not for trachoma. X-ray therapy was also recommended in uveitis which fails to respond to medical treatment, for epithelial tumors of the limbus, for hemorrhagic retinitis, and for retinitis proliferans.

In cases of epiphora from dacryocystectomy, X-ray therapy was found very helpful when applied to the lacrymal gland. In external lesions where malignancy was in doubt, biopsy followed by X-ray therapy was recommended. The value of radiologic consultation in ophthalmology was well established. (48 references)

Paul W. Miles.

Oksala, A. **Melanoma of the choroid examined with an acoustic biomicroscope.** Brit. J. Ophth. **45**:218-222, March, 1961.

The use of echograms as a diagnostic aid in intraocular tumors is a new procedure and is a valuable addition to existing methods. Since ultrasound easily penetrates both the transparent and the opaque parts of the eye, the echograms can indicate the presence of a tumor if it has penetrated into the vitreous for at least two millimeters. Needed for the testing are an ultrasonic apparatus with a crystal for contact and a high-frequency oscilloscope. By changing the point of contact of the crystal and the direction of the crystal, all parts of the eye are examined while photographs of the echograms are being made. The case described is that of a woman who presented diminished vision and a tumor projecting into the vitreous. The echograms indicated that there was heterogenous subretinal tissue rather than fluid and this was born out by examination after enucleation which revealed a melanosarcoma. (4 figures, 8 references)

Morris Kaplan.

Paufique, L., Spira, C. and Charleux, J. **A new treatment of certain ocular disceases: photocoagulation.** J. med. Lyon **41**:1541-1553, Dec. 5, 1960.

The authors discuss the value of photocoagulation in the therapy of 1. retinal lacerations without detachment; 2. retinal lesions predisposing to detachment; 3. retinal periphlebitis; 4. angiomatoses; and 5. small choroidal and retinal tumors. (1 figure, 1 diagram)

Thomas H. F. Chalkley.

Paufique, L. and Barut, C. **Ocular signs of carotid thrombosis.** J. med. Lyon **41**:1569-1583, 1960.

The ocular signs form an essential part of the manifestations of carotid thrombosis. The functional signs, constituted chiefly by transitory amaurosis, are very evocative, especially if they are associated with hemiparetic manifestations located on the opposite side, but they are rather infrequent. Ophthalmodynamometry, when conclusive, virtually confirms the diagnosis. However, due to only partial obstruction, or good collateral circulation, in approximately 25 percent of cases there is no dynamometric expression.

Thomas H. F. Chalkley.

Pinero Carrion. A. **Clinical manifestations of Malta fever.** Arch. Soc. oftal. hispano-am. **20**:1137-1142, Nov., 1960.

In 130 patients with Malta fever during an epidemic in Cadiz, in 1958, 30 were found to have ocular involvement of various types. The ocular symptoms of each

case are briefly reported. Twelve patients had retinal lesions, seven uveitis, four paralysis of an extraocular muscle, three corneal lesions, one paralysis of accommodation, two constrictions of the visual field, two disturbances in pupillary reactions, two subconjunctival hemorrhages, and two central scotomas. The author reaffirms his former statement, that the eye is intimately related to all organs in various ways and reacts with a variety of symptoms in all of its tissues to all types of infection. Most frequently involved in this series was the vascularization of the retina and the uvea.

Ray K. Daily.

Rougier, J. and Royer, J. **Diagnosis of blindness in the infant.** J. Med. Lyon **41**:1521-1537, Dec. 5, 1960.

The diagnosis of blindness in the first year of life may be made by the lack of development of reflexes associated with vision, searching nystagmus, the Franceschetti sign, and obvious ocular malformation. Further examination of the eye should reveal the causative pathology.

Thomas H. F. Chalkley.

Safir, Aran. **The speed of the retinoscopic reflex.** A.M.A. Arch. Ophth. **65**:785-788, June, 1961.

An equation is derived and a curve plotted underscoring the retinoscopic experience that the speed of the reflex serves as a good cue that the end point is being reached. (6 figures, 2 references)

Edward U. Murphy.

Simon, Jose M. **The mathematical calculation of the anterior chamber lens.** Arch. Soc. oftal. hispano-am. **20**:1191-1198, Nov., 1960.

This is the first part of a presentation on the subject of the mathematical calculation of the power of an anterior chamber lens. It does not lend itself to abstracting.

Ray K. Daily.

6

OCULAR MOTILITY

Debrousse, J. Y. **The semiology of the deviometer.** Ann. d'ocul. **194**:296-319, April, 1961.

The author reviews the principle of measurement of ocular deviations in the six cardinal directions of gaze. He then discusses the various apparatus that has been used to measure these deviations, and discusses the resultant picture obtained, which he terms a deviogram. Several case histories are presented which show the difficulty in interpreting combined vertical and horizontal defects, and how in many cases the deviometer helps solve these problems. (30 figures, 6 references)

David Shoch.

Hunt, W. E., Meagher, J. N., LeFever, H. E. and Zeman, W. **Painful ophthalmoplegia: its relation to indolent inflammation of the cavernous sinus.** Neurology **11**:56-62, Jan., 1961.

A syndrome characterized by unilateral retro-orbital pain, ophthalmoplegia, occasional blindness and spontaneous remissions is described. Its etiology is believed to be a low-grade inflammation of the cavernous sinus. Corticosteroid therapy is helpful. (6 figures, 14 references, 1 table)

Thomas H. F. Chalkley.

Jaworska, Maria. **Voluntary nystagmus.** Klinika Oczna **31**:63-65, 1961.

Some, usually young, people are able to produce nystagmus. It is rapid and pendular and lasts less than one minute. Eyes may be straight or converging, and accommodation and miosis are stimulated frequently. A case is described in a man, 24 years of age, who could voluntarily produce rapid, horizontal, pendular nystagmus. His eyes were otherwise normal. The author mentions other types of nystagmus which she links with the voluntary type. (7 references)

Sylvan Brandon.

Lavat, J. **A practical note on the surgery of the oblique.** Ann. d'ocul. **194**:397-410, May, 1961.

The author describes his surgical techniques for recessing the obliques, and for strengthening their action. The recessions are done by disinserting either the inferior or the superior oblique at its insertion and recessing it on the globe according to standard methods popularized by Fink, Stallard and others. Advancements of these muscles are not done because of the danger of involving the macula when bites are taken in the sclera in this area. The author prefers a cinching operation when reinforcement of the action of the oblique muscle is necessary. (5 figures, 4 references) David Shoch.

Mackensen, G., von Noorden, G. K., Rommel, A. and Vogels, W. **Pursuit movements of amblyopic eyes. I.** Arch. f. Ophth. **163**:244-266, 1961.

The nature of the mechanism by which normal eyes maintain fixation on a moving object is first investigated. Upon the gliding motion of the eyes, small nystagmoid jerks are superposed which, beyond a critical velocity, increase until the entire motion is transformed into fixational gaze movements. Pursuit movements are the product of optokinetic stimuli controlled by fixational mechanisms and oculomotor engrams. (18 figures, 2 tables, 50 references) Harri H. Markiewitz.

Mackensen, G., von Noorden, G. K. and Löhr, U. **Pursuit movements of amblyopic eyes. II.** Arch. f. Ophth. **163**: 267-282, 1961.

The authors tested 30 patients with strabismic amblyopia, the amblyopic eye fixating the moving object. The jerks superposed upon the following movements are here more pronounced and disrupt the motion at a lower critical velocity than in normal eyes; this is particularly true when fixation is excentric. The disturbance is independent of visual acuity but rather due to uncertain localization and faulty fixational motor stimuli. (6 figures, 5 tables, 15 references) Harri H. Markiewitz.

Orlowski, Witold J. **Surgical treatment of Stilling-Türk-Duane syndrome.** Klinika Oczna **31**:41-57, 1961.

The author discusses the etiology and the pathogenesis of the Duane syndrome. He feels that it may be of a hereditary nature more frequently than it appears. History of surgical techniques and their variations are presented with particular emphasis on Hummelsheim's method. The mechanism of restoration of abduction is discussed in detail. Four patients operated upon by the author are described. O'Connor's method was used and the postoperative observation period lasted from four months to two years. The author comes to the following conclusions. 1. Indications to operate are the cosmetic appearance and, of less importance, the degree of muscle imbalance, 2. no surgery on horizontal muscles should be done; the only rational approach is to transplant the tendons of the vertical muscles, and 3. Hummelsheim's method straightens the eye, abduction is increased, but adduction becomes more limited, and the total gain in amplitude of eye movement may be only 10 to 15 degrees. (10 figures, 51 references) Sylvan Brandon.

Sachsenweger, R. **The localisation in the brain of stereopsis.** Arch. f. Ophth. **163**:215-225, 1961.

Stereopsis in dogs was disrupted by producing an operative squint, uniocular corneal scars, or aphakia. The occipital cortex was later examined histologically but no changes were found. (3 figures, 2 tables, 27 references) Harri H. Markiewitz.

7

CONJUNCTIVA, CORNEA, SCLERA

Kanagasundaram, C. R. **Two suturing techniques for corneal grafts.** Brit. J. Ophth. **45**:236-239, March, 1961.

The use of direct sutures in corneal grafts is becoming more popular, but one argument against their use is the trauma caused by the fixation forceps when the sutures are put into the donor graft. Two suggestions for remedying this situation are made. In lamellar grafts a blade of polythene presenting a notch in its end is used for counter pressure against the needle; this results in smoother, less traumatic penetration. In penetrating grafts the sutures are introduced into the button after the trephine is introduced only half way into the cornea. These double-armed sutures are then threaded up through the trephine while the penetration is completed and the sutures are already in place without the use of holding forceps. (7 figures, 3 references) Morris Kaplan.

Lindholm, Henning. **Arcus lipoides corneae and arteriosclerosis.** Acta Med. Scandinav. **163**:45-49, 1960.

Arcus lipoides corneae is a condition marked by a line of opacity close to the border of the cornea, from which it is separated by a narrow (0.3 mm.) lucid zone; the overlying epithelium is normal. A synonym is arcus senilis. In the author's series no correlation was found between arcus lipoides corneae and arteriosclerosis, apart from the fact that both increased in frequency with age. (2 tables, 9 references) Thomas H. F. Chalkley.

Magnard, P. **Endoepithelial dystrophy of Fuchs.** Ann. d'ocul. **194**:433-443, May, 1961.

This is a general review of the subject of Fuchs' endothelio-epithelial dystrophy. The author points out that this is a fairly rare disease. Fuchs himself reported only 13 cases in 200,000 patients seen in his clinic. The author then describes the clinical appearance of this dystrophy and states that it starts as cornea guttata involving only the endothelium. Gradually the lesion progresses through the stroma and eventually involves the epithelium as well.

The surgical treatment in this condition is disappointing and in most cases transplants take on the characteristic edema. Treatment should be limited to medical management and baths of hypertonic glucose are most helpful as is the systemic administration of Diamox. (4 figures, 38 references) David Shoch.

Remky, H. and Amann, L. **Precipitating, supporting, and localizing factors in disciform keratitis.** Klin. Monatsbl. f. Augenh. **138**:527-534, 1961.

An analysis of 118 cases of disciform keratitis revealed the following information: a history of trauma was present in only six to seven percent of the cases; in 29 percent of the patients the herpetic lesion developed in a previously damaged eye; in 15 percent active inflammation of sinus, middle ear, or teeth was present; and severe complications and recurrences developed in eyes treated with cortisone. (1 figure, 9 tables, 11 references) Gunter K. von Noorden.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Carroll, M. E., Anast, B. P. and Birch, C. L. **Giardiasis and uveitis.** A.M.A. Arch. Ophth. **65**:775-778, June, 1961.

Giardia lamblia is the commonest protozoan flagellate found in man. A case of uveitis in a nine-year-old girl is described in whom the only positive finding was an intestinal infestation with this organism. Treatment with quinacrine hydrochloride resulted in prompt improvement in the uveal lesion. (3 figures, 9 references) Edward U. Murphy.

Diaz Martines, M. and Llopis Pallares, M. D. **The report of a case of Harada's disease.** Arch. Soc. oftal. hispano.-am. **21**:58-62, Jan. 1961.

The literature is briefly reviewed and a case is reported in a woman, 39 years old, who had a bilateral posterior and anterior uveitis, optic neuritis, and retinal detachment associated with headache, pleocytosis of the cerebrospinal fluid, dysacusia, baldness and alopecia. The entire medical therapeutic gamut was ineffective. Seclusion of the pupil and secondary glaucoma were treated by cyclodiathermy and an antiglaucomatous iridectomy. The final result was a visual acuity of counting fingers at one meter in the left eye.

Ray K. Daily.

François, J. and Mastilovic, B. **Fuchs' heterochromic iritis associated with chorioretinal heredo-degenerations.** Ann. d'ocul. **194**:385-396, May, 1961.

The clinical features of Fuchs' heterochromic iritis are given, and the authors describe four cases in which the lesion was associated with heredo-degenerations of the retina. Two of them were of retinitis pigmentosa and two of Stargardt's disease with some peripheral involvement. The article concludes with references to the literature of other congenital anomalies associated with heterochromic iritis. (4 figures, 28 references)

David Shoch.

Hallett, J. W., Wolkowicz, M. I., Fajardo, R. V., Leopold, I. H. and Wijewski, E. **Antistreptodornase levels in uveitis.** A.M.A. Arch. Ophth. **65**:811-813, June, 1961.

In this study 246 controls and 171 cases of uveitis were utilized. The test failed to indicate any significant relationship of streptococcal infection to uveitis. (3 figures, 4 references) Edward U. Murphy.

Krawczyk, Zofia. **Treatment of uveitis with complicated cataract in small children.** Klinika Oczna **31**:27-29, 1961.

The author states that the great majority of cases of chronic uveitis are of rheumatic etiology, even in small children. The treatment consists in removing any possible focus of infection, giving steroids and salicylates, and the use of atropine, vitamins and diet. Cataracts that have formed are removed when all the signs of inflammation are gone. Prolonged observation is necessary to be assured of complete disappearance of even the slightest symptoms of uveitis. Cataracts should be removed with as little injury to the eye as possible and no lens masses should remain in the anterior chamber. Fairly good visual result may be obtained despite an unfavorable previous history. An example of a child, three and one-half-years of age, is presented where after three years of treatment and observation vision of 5/20 in the right eye and 3/50 in the left eye with correction was obtained. (6 references)

Sylvan Brandon.

Magdalena Castineira Jaime. **Angioid streaks and dislocation of the lens.** Arch. Soc. oftal. hispano.-am. **21**:63-73, Jan., 1961.

This is the report of a case of a sailor, 55 years old, who had marked atrophy of the choroid and pigment epithelium, dislocation of the lenses, one of which was cataractous, vascular lesions, aortic dilatation, senile degeneration of elastic tissues, and kyphosis. The theories on the pathogenesis of angoid streaks are reviewed and the author suggests that the disease is due to a congenital defect of the basal embryonal cells, and that angioid streaks should be included in the collagen diseases. (2 figures)

Ray K. Daily.

Marvas, J. **The innervation and the contraction speed of the ciliary muscle in man.** Bull. et mem. Soc. franç. d'opht. **72**: 45-55, 1959.

The ciliary muscle is a smooth muscle the fibers of which unite and interlace into a unique pattern but, as a whole, hold a meridional course. There are neither redial nor circular fibers and any corresponding nomenclature is therefore erroneous. The nerve supply of this muscle is extraordinarily rich, which makes its unequaled functions of fastness, precision, and maintenance and relaxation of contractions superior to those of any other smooth muscle.

Detailed descriptions of the techniques and the material investigated, summations of the remarkable results achieved, and recognition of the limitations still present in this kind of research work were presented in succeeding chapters, accompanied by series of slides.

Alice R. Deutsch.

Weseley, A. C. **Essential iris atrophy.** A.M.A. Arch. Ophth. **65**:779-782, June, 1961.

A case of this rare condition is reported. Treatment of the secondary glaucoma with miotics and acetazolamide as well as cyclodiathermy was unsuccessful until peripheral iridectomy and scleral cautery according to the technique of Scheie was done. The tension has been well controlled for over one year. (1 figure, 12 references) Edward U. Murphy.

9

GLAUCOMA AND OCULAR TENSION

Blatt, N. **Compression therapy in glaucomatous eyes.** Klin. Monatsbl. f. Augenh. **138**:506-517, 1961.

A compression apparatus was constructed and the effect of ocular compression on the tension was studied in patients with glaucoma. The eyes were compressed four times daily with a weight of 200 to 300 gm. In 28 patients with glaucoma simplex this treatment resulted eventually in permanent reduction of the intraocular pressure. In chronic congestive glaucoma the long lasting hypotensive effect was less significant; in acute congestive glaucoma it was not present at all. The curative effect of compression therapy is due to alteration of vascular and humoral factors. Filtration of the aqueous humor and of intraocular venous blood is accelerated. (6 figures, 21 references) Gunter K. von Noorden.

Comberg, D. and Pilz, A. **Ocular tension and rigidity in experimentally raised venous pressure.** Arch. f. Ophth. **163**:189-202, 1961.

Through venous congestion at the neck the ocular tension rises synchronously with the venous pressure when this is above the intraocular pressure. "Scleral rigidity" diminishes at the same time and is certainly not a measure of the rigidity of the ocular coats. The effects of simultaneous exophthalmos were checked by control experiments with retrobulbar injections of saline solution. (10 figures, 15 references) Harri H. Markiewitz.

Fanta, H. **Tonography during the water drinking test in normal and glaucomatous eyes.** Klin. Monatsbl. f. Augenh. **138**:498-505, 1961.

Ten cases are reported where tonography before the thirty minutes after the fluid intake revealed results which significantly influenced further management of the patients. (10 figures, 11 references) Gunter K. von Noorden.

Frominopoulos, J., Cofinas, H. and Lambrou, N. **Contribution to simplified tonography. The normal values of P_o, C, F, and P_o/C.** Klin. Monatsbl. f. Augenh. **138**:190-199, 1961.

The authors examined 154 eyes of patients under 40 years of age, 230 eyes of patients between 41 and 60 years of age, and 222 eyes of patients older than 60 years. A Schiøtz tonometer was held on

the cornea for four minutes and the scale readings were recorded during the test. The P_o value was determined according to Friedenwald's scale of 1955 and the C and F values were calculated according to Becker and Moses. The grand mean of P_o (all age groups) was 16.15 mm. Hg, with a deviation of ± 2.3 mm. Hg. People older than 70 years showed a slight decrease of the initial tension. The grand mean for the C value was 0.27. There was a steady decrease of outflow with advancing age up to the seventies. This is explained by increased resistance to outflow due to anatomical changes of the drainage system. The grand mean for F was 1.65 ± 0.64. P_o/C showed the following limits: P_o/C less than 100 in normal eyes, from 101-131 in probably anomalous eyes and 132 or more in definitely anomalous eyes. The results of the authors approximate those obtained by B. Becker and W. L. Leydhecker. It is recommended that this simplified method of tonography without the help of costly and complicated instrumentation be widely used in ophthalmic practice. (2 figures, 1 table, 14 references)

Gunter K. von Noorden.

Galin, M. A. and Nano, H. D. **Intravenous urea in ophthalmology.** Arch. oftal. Buenos Aires **36**:22-25, Jan.-Feb., 1961.

When given intravenously as a 30 percent aqueous solution in 10 percent invert sugar solution urea acts as a powerful osmotic ocular hypotensive agent if administered in a dose of 1 gm. per kg. body weight. Two cases of acute, angle-block glaucoma which failed to respond to miotics and to the administration of acetazolamide, showed a dramatic fall in pressure following the utilization of hypertonic urea. In one case of hypertensive uveitis with complicated cataract, a similar drop in tension permitted the surgeon to perform without difficutly a basal iridectomy with synechiotomy. In a further case of a glaucoma, secondary to a massive intraocular hemorrhage of traumatic orgin which was presumably confined to the anterior chamber, the intraocular pressure decreased to a normal level with intravenous urea; the anterior chamber could then be irrigated through a limbal section, after which complete visual recovery occurred. In two cases of retinal detachment in which a scleral buckling had to be made by means of either a polyviol implant of a circling polyethylene tube, the administration of urea made it possible to tie the scleral sutures without giving rise to an undue increase in tension. (11 references)

A. Urrets-Zavalia, Jr.

Gittler, R., Kraupp, O. and Pillat, B. **The question of the effective mechanism and dosage of Tosmilen eye drops.** Klin. Monatsbl. f. Augenh. **138**:558-561, 1961.

This is a critical review and a discussion of recent papers on the site of action and dosage of Tosmilen in the therapy of glaucoma. (22 references)

Gunter K. von Noorden.

Kästner, M. **Trepanation iridencleisis.** Klin. Monatsbl. f. Augenh. **138**:199-210, 1961.

This procedure was described by Rohrschneider and consists of trephining combined with iridencleisis through the trephine opening. To determine the effectiveness of this combined procedure, 33 cases in which it was used are compared with 62 cases in which only trephining and 32 in which only iridencleisis was done. Surgical complications occurred with the same frequency in all three groups. The combined procedure was more effective in lowering the tension but decrease of vision and field loss were more pronounced in this group. In patients with hydrophthalmos the combined procedure appears to be especially effective. (3 figures, 4 tables, 22 references)

Gunter K. von Noorden.

Leydhecker, W. **Diagnosis of early primary glaucoma.** Arch. oftal. Buenos Aires **36**:16-21, Jan.-Feb., 1961.

Whenever the presence of subjective symptoms (blurring of vision with associated rainbow-colored halos and headaches) points to the possibility of early glaucoma of the angle-block type, the diagnostic routine should consist of gonioscopy (which will invariably show that the anterior chamber angle is narrow) and of repeated tonometry (in order to find out what the diurnal variations in tension are). Ophthalmoscopy and perimetry are of absolutely no avail in the early stages of the malady. If necessary, the darkroom test and the homatropine mydriasis test may be used. The absence of early subjective symptoms in simple glaucoma should lead every ophthalmologist to check the ocular tension in every presbiopic patient; a reading of 3.5 divisions with the 5.5 g. weight of a standardized Schiøtz tonometer should be considered suspect, and a reading of 2.5 with the same weight a sure sign of glaucoma, provided that an abnormally high scleral rigidity may be ruled out. If necessary, the diurnal tensional curve may be established, or the water-drinking test or the priscoline test carried out. Perimetric changes are to be looked for in the immediate vicinity of the blind spot with very fine targets. Demonstrable ophthalmoscopic changes in the form of pallor and cupping of the disc are of relatively late appearance and do not show the beginning of the glaucomatous process. The angle may be wide or narrow but is always open. Tonography may be of diagnostic value only if the 3 to 7 per minute part of the curve is considered; the significance of the individual data is enhanced if the fraction Po/C is taken as an index of the facility of outflow in lieu of the coefficient C. (11 references)

A. Urrets-Zavalia, Jr.

Macri, F. J. **Interdependence of venous and eye pressure.** A.M.A. Arch. Ophth. **65**:442-449, March, 1961.

In eyes of cats, the venous and ocular pressures are directly related. Similar anatomic conditions are not found in the human eye. (7 figures, 3 tables, 11 references)

Edward U. Murphy.

Moreno Lupianez, E. and Gonzalez Costera, J. A. **Emergency preoperative preparation in acute glaucoma.** Arch. Soc. oftal. hispano-am. **20**:1186-1190, Nov., 1960.

The author presents a pattern of treatment for acute glaucoma which he found satisfactory in a series of 30 patients. As soon as the diagnosis is made a 5 to 7-percent solution of pilocarpine is instilled every five minutes, alternating with a one half-percent solution of eserine. Every ten minutes a one and one half-percent solution of carbochol is instilled. This is continued for one hour, and then the instillations are made every one or two hours. Luminal is given intramuscularly for its effect on the central nervous system; of Diamox two tablets are given by mouth and the contents of one ampule is injected intramuscularly, for the suppression of aqeuous formation; of Hydergin one ampule is given intramuscularly for its adrenolytic and sedative effect and for its elective action on the hypothalamus; and 500 cc. of hypertonic glucose solution is used at the rate of 20 drops per minute for its effect on the interstitial fluids. Five briefly reported cases illustrate the effectiveness of this pattern of treatment. (5 tension curve charts)

Ray K. Daily.

Ohm, J. **Can the cause of glaucoma simplex be recognized?** Klin. Monatsbl. f. Augenh. **138**:259-260, 1961.

The author suggests that changes in intraocular pressure could be due to hyper-

secretion of the ciliary body in response to local undercooling of the body.

Gunter K. von Noorden.

Perez-Bufil Pichot, Gabriel. **Tension and campimetry in simple glaucoma.** Arch. Soc. oftal. hispano-am. **20**:1171-1184, Nov., 1960.

The author discusses the theoretical, mathematical and anatomic factors involved in tonography and campimetry. The author confirmed Thiel's observation on the role of the position of the body on ocular tension, by checking normal and glaucomatous eyes in different positions of the body. In 22 glaucomatous eyes he found that the ocular tension had been reduced from three to six mm. ten minutes after the patient had assumed an erect position. This change was also found in the control series. It is attributed to the diminution in the ocular vascular supply produced by the dilatation of the cerebral vessels to maintain a constant volume. If a similar response does not take place in the eye the uveal blood supply is diminished and the ocular tension falls. The author therefore advocates checking the ocular tension in the morning before the patient rises.

Ray K. Daily.

Pilz, A. and Comberg, D. **Circulation dependent variations in ocular tension.** Arch. f. Ophth. **163**:203-214, 1961.

Simultaneous registration of venous, arterial, and intraocular pressure helped elucidate in detail the influence of complex hemodynamic moments upon ocular tension. Ocular tension is governed mainly by the extrabulbar arterial pressure, though the venous pressure is determinant when it exceeds the intraocular one. The variability of the reactions in experimental and pathologic (glaucoma) states is demonstrated. (10 figures, 11 references) Harri H. Markiewitz.

Tesauro, N. **Experimental research on the possibility of lowering the intraocular pressure by suture placed through subscleral space into the anterior chamber.** Arch. di ottal. **64**:271-282, Sept.-Oct., 1960.

A Supramid suture was placed from the subscleral space into the angle of the anterior chamber of rabbit eyes by means of a needle or a grooved spatula. Various methods were tried, including the placing of the suture in a hypodermic needle for insertion. The outside ends were tied under or over the conjunctiva. After two months, the tension had remained at a level well below that of the controls. (10 figures, 23 references) Paul W. Miles.

Zenatti, E. **Diagnostic significance of tonosphygmography in chronic glaucoma.** Bull et mem. Soc. franç. d'opht. **72**:128-134, 1959.

Tonosphygmography supposedly is a method to establish with precision the intravascular pressure of the choroidal network. It also should give additional information on physiologic details of the normal and abnormal eye. The instrument consists of a manometric chamber whose pressure is progressively increased while registering a simultaneous applanation of the cornea. The electronically recorded tracing consists of three parts, a slow slope, an abrupt decline and again a slow slope. The abrupt decline corresponds to the applanation of the cornea and to the achievement of an equilibrium between intra-ocular and osmotic pressure. This special part of the tracing which can be expressed in mm. of Hg coincides with the pressure in the choroidal vessels. A small comparative study of normal and glaucomatous eyes demonstrated constant high values of the reading in the latter group. This was considered to be another proof that primary glaucoma is a vascular disease. Some doubt is expressed, however, concerning the correctness of the

equalization of the registered values with the systolic and diastolic pressure in the choroid. Alice R. Deutsch.

10

CRYSTALLINE LENS

Barraquer, J. **Enzymatic zonulolysis in 1960.** Arch. d'opht. **20**:829-834, Dec., 1960.

Barraquer summarizes his experience with enzymatic zonulolysis in 757 cases of cataract operated upon between January, 1958 and May, 1960. He concludes that alpha chymotrypsin in 1-5,000 dilution, instilled into the posterior chamber, produces lysis of zonular fibers in patients of all ages, and that if proper precautions are taken there will be no secondary effects on other structures of the globe. In the age group of 30 to 60 years, enzymatic zonulolysis enormously facilitated extraction of cataract, allowing total extraction in all of the cases. The author had good results in the 20 to 29-year age group but certain difficulties in the 10 to 19-year age group, and he does not attempt total extraction in children under 10 years of age. In traumatic cataract he found zonulolysis useful. In patients beyond the age of 60 years he found the procedure unnecessary except in the rare cases of fragile capsule or resistant zonule. (1 figure) P. Thygeson.

Boissin, J. P. **Galactosemic cataract.** Ann. d'ocul. **194**:422-432, May, 1961.

The author reports the case of a newborn infant with galactosemia and a typical galactosemic cataract. The characteristic changes in the blood, urine and liver are described and the author reviews the recent work of the enzyme deficiencies in this disease. He concludes by stating that the treatment is a removal of all galactose from the diet, and illustrates this in his own case where a complete disappearance of the lens opacities resulted when galactose was removed from the diet in this infant. (81 references) David Shoch.

D'Agostino, A. and Manes, L. **The weight and water content of human cataract lenses.** Arch. di ottal. **64**:377-388, Nov.-Dec., 1960.

Cataracts from 106 eyes were removed intact, and were studied with nine normal lenses removed from keratoplasty donor eyes. They were weighed before and after dehydration at 110°C. for eight hours at 750 mm. of mercury vacuum. The cataract from trauma had an average weight of 173 mg., and a water content of 63 percent. Normal lenses in youth weighed 183 mg., water 68 percent. Normal lenses in the aged weighed 222 mg., with water 70 percent. Cataracts in the aged weighed 212 mg., water 64 percent. Ten cataracts in high myopia did not vary from the average. One black cataract weighed 304 mg., and had 35 percent water content. (5 tables, 12 references) Paul W. Miles.

François, J., Velissaropoulos, P. and Topalis, C., Avanza, C. and Balavoine, C., Franceschetti, A. and Dieterli, P. and Delthil, S. and Crouzet, M. J. **Symposium: Congenital Cataracts.** Bull. et. mem. Soc. franç. d'opht. **72**:297-399, 1959.

François, J. **Congenital cataracts.** pp. 297-313.

In his magnificent report, the author summarized all the information on congenital cataracts available at the present time; in this particular paper, however, he restricted himself to one special detail, namely fetal anomalies of the lens, related to an incomplete regression of the perilental, vascular sheath.

Remains of the hyaloid artery are frequently seen. Their appearance varies, from small cork-screw like dots and coils to extended grayish fiber-like threads at the nasal quadrant of the posterior lens

capsule. Posterior cortical cataracts also may occur under divers shapes. Sometimes only a sharply outlined white dot is visible at the posterior pole. In other cases vacuoles and strangely contoured dots accumulate, not only under the posterior capsule but also invade the center of the lens. A persistent hyaloid artery denotes its close relationship to the development of such a cataract.

The persistence and hyperplasia of the primary vitreous serves as one of the most serious anomalies associated with a persistence of the hyaloid vessels and the posterior vascular sheath of the lens. This malformation occurs as a monocular incident in full-term, otherwise normal infants. Mild microphthalmus may be visible. The anterior chamber is shallow, the pupil dilates poorly, and the iris shows dilated vessels which occasionally pass the pupillary border to disappear in the posterior chamber. A whitish mass fills the center of the pupil. It is thicker in the center than at the periphery, touches the posterior pole of the lens, has a slightly concave anterior surface and is highly vascularized. In dilated pupils the thinned and stretched ciliary processes seem to be adherent to and even may penetrate into the central mass. The lens is mostly small and initially clear; it often becomes cloudy. The development of such a cataract frequently is connected with considerable swelling, increasing shallowness of the anterior chamber, and secondary hypertension. A spontaneous resorption of the lens also may occur; rarely, densely vascularized connective tissue invades the capsular sac, sprinkled by cells filled with fat and by hemosiderine crystals, the remnants of intralenticular hemorrhage. Such a symptom complex, which is very rare, is called pseudophakia.

The author also discussed four of his own cases of primary persistent vitreous, and outlined the signs and symptoms which are of use in the differential diagnosis of primary persistent vitreous and congenital cataracts. (11 figures)

Velissaropoulos, P. and Topalis, C. **Alpha-chymotrypsin in the surgery of congenital cataracts.** pp. 314-330.

The usefulness of alpha chymotrypsin in the extraction of juvenile cataracts has been disputed by many authors, who have enumerated the potential hazards and emphasized the many serious inherent complications. Congenital cataracts appear in three different forms, a total cataract under the shape and size of the average normal lens, a total cataract preserving the shape but much smaller than a normal lens, and finally a membranous cataract. There are various, essential particularities characteristic of those cataracts which demand specific precautions and special surgical techniques. The zonular fibers are very tough, which makes intracapsular extraction very difficult; there are also more or less dense adhesions between the lens capsule and the hyaloid membrane as well as with the posterior surface of the iris. The authors describe their modification of intracapsular cataract extraction of congenital cataracts. They stress the importance of the use of a more concentrated solution of alpha chymotrypsin, namely a solution of 1/4,000. They use this solution several times, preferably three times; they wait for several minutes before they rinse the anterior chamber; they free the adhesions betwen the iris and the lens capsule; and they gradually and carefully break the retrolental synechiae with a spud before they extract the completely freed lens. They present the impressive list of 21 intracapsular cataract extractions successfully performed in persons two to twenty years of age. The complications were five ruptures of the capsule and five times a loss of vitreous. The children tolerated the procedure well and surgical results were unusually good. (2 tables)

Avanza, C. and Balavoine, C. **A new**

bio-type of cataracta umbilicata associated with brachymorphia, external ophthalmoplegia, and hyperamino-aciduria. pp. 331-340.

The cataracta umbilicata is a very serious congenital anomaly which is caused by a complete failure in the development of the nucleus. The anterior capsule is generally thickened, at least in the area of the anterior pole, and the posterior capsule, on the contrary, is thin and friable. There is also an opaque mass between the capsular sheaths. The surgical removal is difficult and hazardous; because of the danger of retinal detachment preventive cyclodiathermy has been suggested. The visual results after cataract extraction are poor as the maculae are apparently hypoplastic. The pedigree of a family is presented. The parents, who were brachymorphic, had no ocular difficulties, but of their eight children, four had ocular anomalies. Three of the abnormal siblings could be examined at the ophthalmologic clinic at Geneva. One patient, a 36-year-old man, presented the complete syndrome, brachymorphic habit, paralytic esotropia, thick, short fingers, and hyperaminoaciduria. The form of heredity was classified as intermediary dominance. The brachymorphic habit of the parents might be an abortive manifestation in the heterozygotic stage, whereas the more or less complete syndrome in their descendants corresponds to the homozygotic stage. There is also a certain relationship between the syndrome under discussion and Marchesani's syndrome. In Marfan's syndrome the heterozygotic carriers of the gene only have a simple brachymorphia, while the heterozygotes demonstrate a microphakia with or without ectopia of the lens. (4 figures, 34 references)

Franceschetti, A. and Dieterle, P. **Congenital fusiform cataract (cataract en pagode) and its relationship with the cataracta centralis pulverulenta.** pp. 341-351.

The interrelationship of the various congenital nuclear and perinuclear malformations of the lens is so difficult to recognize because only very few clinical and genetic studies have been published on this subject. The so-called fusiform cataract is a congenital cataract in which an anterior and posterior polar opacity by a tube-shaped or a spindelshaped central cataract are united. Whereas this rare congenital cataract was already described by Ammon and other authors more than one hundred years ago, descriptions of this complete anomaly became very scarce during the present period of biomicroscopy. Nevertheless anterior polar and posterior polar cataracts with stalk-shaped connections with their imprints or with tube-shaped opacities towards a central cataracta pulverulenta have been described. The authors observed two patients with cataracts belonging to this group. Both, however, were incomplete. The first presented an anterior pyramidal cataract connected by a stem with a central cataracta pulverulenta and a layer of riders. In the second case a monocular cataract consisted of a posterior polar cataract and a string-shaped opacity which united this cataract with a central disc. As far as the pathogenesis is concerned, the peculiar shape of the opacities could be explained by primary damage to the embryonic nucleus, and by a diminishing insult in the succeeding months so that only the most viable points were affected later on, namely the junction of the fibers at the anterior and posterior pole, respectively. Cataracta pulverulenta centralis has always been considered to be transmitted by typical regular dominance. Recessive afflictions are usually more pronounced than the similar dominant abnormalities seen in case I previously discussed. (6 figures, 23 references)

Delthil, S. and Crouzet, M. J. **Cataracts and other congenital malformations of the anterior segments among the pupils of**

the sight-saving classes at Paris. pp. 352-368.

The association of congenital cataracts with various ocular and systemic congenital anomalies has always been of great interest, especially toward a better understanding of genetic phenomena. Synoptic presentations as delivered by the authors are of considerable significance because they allow a comparison of their findings with statistical reviews from various sources. Eighty-eight pupils at a school for amblyopic individuals were investigated. Mentally retarded or children with obvious extra-ocular vital malformations were excluded; so were children with congenital glaucoma. The preponderance of congenital cataracts among congenital malformations in general was overwhelming. The same was true for the actual number of concurrent abnormalities and hereditary traits in their etiology. The best postsurgical results with surprisingly gradual improvement in visual acuity were in the older age-group (about five years old) and solitary cataracts. Other important factors essential to the development of these pupils were their mental capacity and their home surroundings. The worst results were in children operated on before two years of age and in the presence of multiple concomitant malformations. The frequency of strabismus was also recognized. It was, however, considered to be an associated anomaly and not caused by the amblyopia. In the following discussion, Mme. Braun-Vallon and Mme. Fontaine presented their experiments at the Hospital des Enfants Malades and à l'Ecole de Puericulture whereas, Guendet reported the statistics from La Clinique Ophthalmologique de Lausanue. (9 tables)

Discussion of the report on congenital cataracts. pp. 369-399.

Renard discussed a syndrome, observed by him, but never published before. It was seen in a mother and daughter. Their teeth were unusually long and of defective implantation; their facial structure was distorted; their noses flat and hypertrophic. They also had congenital cataracts. He also stresses the hazards of cataract operations in microphthalmic eyes and in carriers of Marfan's syndrome.

Hambresin had some words of warning concerning the needling of congenital cataracts with a hard but transparent nucleus.

Calmettes joined the other discussers in his admiration of J. François' marvellous report. He also suggested extreme care and judgement in the motivations for removal of congenital cataracts because of the potential adhesions between posterior lens capsule and vitreous. He never operates before the end of the first year; he does extracapsular lens extractions after 12 years and intracapsular extractions after 20.

Onfray reported the case of a bilateral peri-nuclear cataract which increased in density and was successfully needled when the patient was 12 years old. Within 16 years the patient had a recurrent vitreous hemorrhage, ascribed to a tuberculous allergic reaction and a metabolic imbalance, namely a hyperfunction of the pituitary with an excess of thyroid stimulating hormone.

Valiere-Vialeix described his experiences with a two-year-old mentally retarded child, who had a dense posterior cortical cataract in addition to multiple dot and crystalloid central opacities, which could have been acquired after birth during a severe intestinal upset. This child also had depigmented retinal lesions and a cervical spina bifida arthrogryposis. The discusser also added some corrective information concerning the action of pachycurare and leptocurare as used in anesthesia. Pachycurare fixes itself at the neuromuscular endplate and prevents the depolarizing action of acetylcholine. Leptocurare depolarizes the motor endplate and its fibers so that the ac-

tion of acetylcholine becomes ineffective.

J. Sedan delivered several useful arguments on the subject of congenital cataracts. He called attention to the fact that a total bilateral congenital cataract should be operated on between 6 and 12 months of age in the first eye, and a few months later in the second eye, which might otherwise become irrevocably amblyopic. He is a convincing advocate of iridectomies in central congenital cataracts in spite of the disapproval of many contemporary ophthalmologists. The comparatively large series of 33 iridectomies on patients of whom 59 percent were able to get the highest form of education and better visual acuity than most aphakics, were a good test for the correctness of his statements. As far as surgery was concerned, he prefers needlings. His techniques are Paufique's methods with two knife-needles. He also is a strong believer in contact lenses, which he tentatively suggests even for the very young.

Dollfuss stressed the significance of congenital lens opacities in medico-legal situations. He suggested that in any kind of employment in which there is a possible contact with irradiation of any kind, a survey of the lenses should be made in any prospective employee, and this should be followed by periodic re-examinations.

Babel presented his classification of congenital cataracts; cataracts caused by abnormal fetal development, cataracts due to metabolic disturbances, congenital embryopathic cataracts, caused for instance by viral infections or maternal nutritional or toxic states, and finally postnatal acquired cataracts.

Bauzas found six retinal detachments in his series of surgically treated congenital cataracts.

Delmarcella quoted the case history of a 30-year-old man with a typical Marfan's syndrome complicated by high intraocular pressure. The patient also had an ectopy of the pupils, a phenomenon never described previously in this group of mesodermic dysplasias. The ectopy of the pupils was found in three consecutive generations.

Appelmans discussed the lens opacities of a litter of rabbits after the mother rabbit was injected with an emulsion of lens material.

Algan presented a classification of the congenital cataracts at the medical school of Nancy.

Regard reported the case of a unilateral microphakia.

Baron demonstrated a new forceps for the removal of capsule rests.

Trantas observed the peculiar case of a bilateral progressive, posterior lenticonus. The lens capsule finally ruptured, followed by a slow, but practically complete spontaneous resorption of the lens material.

Stankovic investigated the calcium content of the blood serum and anterior chamber in a small series of congenital cataracts, unrelated to tetany or rickets. He found calcium to be normal in the serum but decreased in the aqueous.

François, after answering in details the many questions asked during the discussion once more summarized the poor experiences of various authors in doing intracapsular cataract extractions with alpha chymotrypsin in children and young adults. As far as the incidence of late retinal detachments after surgery for congenital cataracts was concerned, he believed that this was a special disposition to retinal detachment and independent of the surgical technique.

Alice R. Deutsch.

Hamburger, F. A. **Cataract extraction by means of the suction method.** Klin. Monatsbl. f. Augenh. **138**:517-527, 1961.

The author reports his experiences with the Bell erisophake in cataract surgery. He evaluated 561 cases and compared the surgical results of forceps extraction with

results achieved with the erisophake. His study demonstrated that the erisophake yields results which are at least as good as those obtained with forceps delivery of the lens. In intumescent cataracts the erisophake is the instrument of choice. (5 figures, 5 tables, 6 references)

Gunter K. von Noorden.

vom Hofe, K. **Clinical experiences with a method called light coagulation.** Klin. Monatsbl. f. Augenh. **138**:387-393, 1961.

The author had disappointing results with light coagulation in retinal detachments with peripheral tears because even small amounts of subretinal fluid prevented the effects of coagulation to become visible. Genuine macular holes with a flat retina can be successfully treated with light coagulation. The treatment of melanosarcomas prior to enucleation resulted in shrinkage of the tumor in one case without significant histologic destruction of the neoplasm. Four small chamber-angle metastases of a lymphosarcoma could be destroyed by light coagulation. (1 table, 13 references)

Gunter K. von Noorden.

Kennedy, P. J., Jordan, J. S., Morrison, J. F., Mulberger, R. D. and Boland, S. W. **Enzymatic zonulolysis as an aid in cataract surgery.** A.M.A. Arch. Ophth. **65**: 801-804, June, 1961.

An additional 491 cases are discussed by these authors who previously reported 432 cases. Their results were better when the enzyme was used and they recommend its careful use. (5 references)

Edward U. Murphy.

Lerman, Sidney. **Pathogenetic factors in experimental galactose cataract. Part IV.** A.M.A. Arch. Ophth. **65**:334-337, March, 1961.

Further evidence of the hexose monophosphate shunt in lenses of young rats was obtained. The levels of oxidized and reduced di- and triphosphopyridine nucleotides were measured. (1 figure, 3 tables, 13 references) Edward U. Murphy.

Leydhecker, W. **Does surgery with alpha-chymotrypsin damage the eye? A report with gonioscopic and electro-tonographic studies.** Klin. Monatsbl. f. Augenh. **138**:381-387, 1961.

Eighteen patients who underwent cataract surgery with zonulolysis were compared with sixteen patients who had surgery without the enzyme. Gonioscopy and tonography were performed pre-operatively, as well as three to four months after surgery. A protrusion of the vitreous into the anterior chamber was the only complication observed in the group in which chymotrypsin had been employed. Neither tonography nor gonioscopy revealed any differences between the two groups. Zonulolysis is especially indicated in patients between 30 and 60 years of age, who have myopia, diabetes or traumatic cataracts. (2 tables, 27 references) Gunter K. von Noorden.

Lugossy, G. **Operation of cataract in the high myope.** Arch. d'opht. **20**:835-839, Dec., 1960.

The author discusses cataract extraction in high myopia, with particular reference to the risk of postoperative retinal detachment and to the indications for the intracapsular and extracapsular procedures. On the basis of his experience with 109 high myopes, Lugossy concludes that intracapsular extraction is preferable and that alpha chymotrypsin facilitates the operation. He prefers to use round pupil extraction with preplaced corneoscleral sutures. Only 1.6 percent of the patients developed retinal detachment. (6 tables, 22 references) P. Thygeson.

Menna, F. **Histologic changes in the lenses of guinea pigs subjected to low temperature.** Arch. di ottal. **64**:389-398, Nov.-Dec., 1960.

Guinea pigs were refrigerated at 10° below zero for from one to 12 hours. This produced characteristic changes in the eye. (7 figures, 7 references)

Paul W. Miles.

Moore, J. G. **Cataract extraction with alpha-chymotrypsin. A controlled trial.** Brit. J. Ophth. **45**:197-201, March, 1961.

A series of 50 consecutive cataract extractions was performed with identical technique using anterior chamber irrigation with the contents of 50 numbered ampules some of which contained alpha-chymotrypsin and others an inert substance. The surgeon who was totally unaware of the contents of each ampule made precise notes of any differences in the facility of surgery. The lenses were removed by the sliding technique without pressure from below or above. In only two cases was the capsule ruptured. After completion of the series, the data were compared and it was concluded that ACT does indeed have a useful action in freeing the lens and in increasing the proportion of successful intracapsular extractions. Its action, however, is not considered to be absolutely constant. (2 references)

Morris Kaplan.

Offret, G., Haye, C. and Campiuschi. **Histologic examination of an eyeball after cataract extraction with chymotrypsin.** Bull. et mem. Soc. franç. d'opht. **72**: 134-146, 1959.

A 72-year-old man died of a pulmonary infarction six days after a cataract extraction with alpha-chymotrypsin. Both eyes were obtained at autopsy and both were very carefully investigated. It was found that the anterior zonular fibers only were involved in the break. They were abruptly divided half-way between their insertion on the ciliary body and the lens capsule. The posterior zonular fibers, on the contrary, had preserved their integrity. Mild inflammatory reaction was found in the cornea, the iris, and the chamber angle. This was ascribed to the surgical trauma. No inflammatory infiltration was found in the region exposed to the effect of alpha-chymotrypsin. The authors and the discussers recognize their inability to explain the exact mechanism of the action of alpha-chymotrypsin. They also recognize the many scientific problems introduced by the use of histochemical methods. It is generally known that trypsin, which is three times as active as alpha-chymotrypsin, has various elements of attack while alpha chymotrypsin can act only in the presence of benzyl and para-hydrobenzyl radicals. Among the amino acids only phenylalanine and tyrosine carry these constituents. With the help of Millon's reaction it could be shown that the zonular fibers contain tyrosine and therefore could be attacked by alpha-chymotrypsin. This study unquestionably does not only contain interesting observations but also original ideas for future research.

Alice R. Deutsch.

Oksala, A. **Acoustic structure of the opaque and transparent lens.** Klin. Monatsbl. f. Augenh. **138**:374-380, 1960.

Transparent lenses do not reflect sound waves and the echogram is negative. However, when there is density of the nucleus, the reflected echo can be registered. The amplitude of an echo reflected by a dense nucleus is lower than that resulting from a foreign body in the lens. The size of the nucleus can be determined prior to cataract surgery by means of echography. (5 figures, 4 references)

Gunter K. von Noorden.

Otto, J. and Hähnel, R. **The peptidase content of the lens in senile cataract.** Klin. Monatsbl. f. Augenh. **138**:354-358, 1961.

Cataractous lenses from humans were compared with normal lenses from rabbits. The peptidase content was determined by a paper chromatographic

method. Reduced ferment activity was present in cataractous lenses, if compared with normal lenses. Addition of metallic ions to the lens extract increased the ferment activity. In this respect cataractous lenses exhibit properties which are similar to those of normal lenses. (2 tables, 4 figures, 5 references)

Gunter K. von Noorden.

Pau, H. **Coronary cataract.** Klin. Monatsbl. f. Augenh. **138**:345-352, 1961.

Coronary cataract occurs in 25 percent of all patients after puberty (Vogt). The characteristics of these opacities are described. They represent acquired lesions, their appearance resembles "glaucomatous spots," their course and progression is somewhat similar to a post-traumatic cataract. It is postulated that in patients with an existing disposition, especially in juvenile individuals, zonular traction could result in transitory superficial changes of the lens. This would lead to the formation of vacuoles which gradually migrate into deeper layers and become opaque, thus eventually leading to coronary cataracts. Histologic sections were studied in one case. (8 figures, 11 references) Gunter K. von Noorden.

Paufique, L. and Ravault, M. **Enzymatic zonulolysis: recent progress in cataract operations.** J. Med. Lyon **41**:1489-1496, Dec. 5, 1960.

The use of alpha chymostrypsin in cataract surgery is explained, indications are given, and the advantages are discussed. Prudence is advocated.

Thomas H. F. Chalkley.

Paulus, W. **Studies on thiamine content in the lens.** Arch. f. Ophth. **163**:19-24, 1961.

The amount of thiamine in the lens does not vary with species or age. (3 figures, 1 table, 7 references)

Harri H. Markiewitz.

Schirmer, K. E. and Mellor, L. D. **Corneal sensitivity after cataract extraction.** A.M.A. Arch. Ophth. **65**:433-436, March, 1961.

A lessened sensitivity can be demonstrated in the upper half of the cornea, and is present without change up to two years after surgery. There was no difference between the corneal and the limbal sections. The author suggests that the easy tolerance of corneal contact lenses by aphakics is related to this phenomenon. (5 figures, 4 references)

Edward U. Murphy.

Uher, Miroslaw. **Hemorrhage into the lens as a complication of filtrating operation in glaucoma.** Klinika Oczna **31**:67-69, 1961.

The author presents a case of hemorrhage into the lens following sclerotomy and iridectomy in an eye which had had iridencleisis two years before and where the pressure was high again. On first dressing only a small amount of blood was noticed in the pupillary area, but on the fourth day after surgery the patient noticed a considerable decrease of vision. Examination with the slitlamp revealed the presence of blood under the capsule, in the cortical layer and between the latter and the nucleus. After two months of observation there was almost no change in the amount of blood in the lens and the visual acuity remained quite poor. (1 figure, 4 references) Sylvan Brandon.

Urrets-Zavalía, A., Jr. **Surgical treatment of congenital cataracts.** Revista Colombiana de Oftalmología y Otorrinolaringología **10**:15-26, March, 1961; also, Arch. oftal. Buenos Aires **36**:26-34, Jan.-Feb., 1961.

From a surgical point of view, congenital cataracts may be divided into two fundamental groups, according to whether the affected lens is of an approximately normal volume (and this regardless of

the extent and density of the prevailing opacity) or is reduced to a membrane of variable thickness.

In the first type of case, an early discision should be performed, preferably by means of two needles which enter the anterior chamber simultaneously at both the nasal and temporal limbal ends of the horizontal meridian. The anterior lens capsule must be widely opened, but on no account should the points of the instruments be allowed to divide the posterior capsule. Immediately following the operation the lens substance swells rapidly and absorption occurs in three to twelve weeks. Should the intraocular pressure increase after the operation, every effort must be made to control it by medical means; as this may easily be achieved in a matter of days, an irrigation of the anterior chamber will have to be decided upon only exceptionally for, contrary to the accepted view, multiple posterior synechiae are more apt to develop after this procedure—as they are also after linear extraction—than when resorption of the opaque masses is left to proceed undisturbed. In those instances in which a membranous secondary cataract develops, a capsulotomy such as is used in the next type of case must be resorted to as a secondary procedure.

In the somewhat rarer cases where the lens is reduced to an opacified membrane, a vertical or horizontal straight capsulotomy with the Wheeler knife is considered the method of choice.

Of greatest importance in dealing with congenital cataracts seems to be the fact that far better results are obtained when one avoids opening the anterior chamber and manages to operate with the aid of limbal punctures and stab incision only. (2 figures, 8 references)

A. Urrets-Zavalía, Jr.

Vancea, P., Batcu, V. and Vancea, P. D. **Aspects of lipoprotein metabolism in cataract.** Klin. Monatsbl. f. Augenh. **138**: 359-366, 1961.

Changes of the protein fraction of the serum was present in patients with cataracts. Albumins were decreased, and alpha and gama globulines increased. Tests for dysproteinemia revealed a change in the colloid stability of the serum and confirmed changes in the globulin fractions, which have been previously reported. Study of the cholesterol fractions revealed not only a decrease of the blood cholesterol after cataract surgery but also a significant alteration of the ratio: free cholesterol/esterified cholesterol. The results are discussed and the authors emphasize that cataract is not only a local disturbance of the eye but an ocular manifestation of generalized disease. (1 table, 3 figures, 4 references)

Gunter K. von Noorden.

Vancea, B., Batcu, V., Batcu, A. and Cernatescu, D. **Contribution to the study of the dynamics of phosphorylation in cataracts.** Klin. Monatsbl. f. Augenh. **138**: 366-374, 1961.

Phosphorylation processes were studied by means of the honey test (Fillinsky) in 17 patients with cataracts. Phosphoremia and excretion of phosphoric salts were decreased. The hyperglycemia resulting from the intake of honey resembled that of hepatic or pancreatic insufficiency. The dynamics of phosphorylation seem to be significantly disturbed in patients with cataract, since a cessation of these processes were observed after administration of honey. (3 tables, 13 references)

Gunter K. von Noorden.

Vörösmarty, D. **Photocoagulative operation of cataract and secondary cataract.** Ophthalmologica **140**:303-311, Nov., 1960.

It is sometimes dangerous or unrewarding to do repeated surgical procedures on the secondary cataracts of some

complicated eyes. For example, massive thickening of lens remnants with iris adhesions will rarely yield to a simple discission, and an adequate removal of all the pupillary contents may require as much of an operation as that performed originally, with its attendant complications. One is reluctant to subject eyes where a flare-up of a pre-existant uveitis is feared to an intraocular surgical procedure. For such cases the use of the photocoagulator offers real advantages. The procedure is extraocular; reaction is minimal. Results are more slowly obtained, and the treatment may have to be repeated several times, but the poor surgical prognosis of the eyes selected for this treatment makes a lengthy period of therapy justifiable if a favorable outcome may thereby be obtained. Since only pigmented tissue absorbs enough heat to cause tissue destruction, non-pigmented pupillary masses require initial pigmentation. This is accomplished by injecting a drop of the patient's own blood, diluted 1 : 5 with 3.8 percent sodium citrate, into the anterior chamber or into the pupillary mass, and fixing it by a short exposure to the photocoagulator beam. A later full photocoagulation is then effective. The procedure is repeated at 8 to 14-day intervals until a satisfactory hole is formed. A discission is occasionally necessary as a final procedure but after the light treatment the material fragments easily and falls away from the pupil. The only contraindication is an exceedingly shallow anterior chamber, in which case the proximity of the heat absorbing pupillary material may cause warming of the cornea and opacification. A preliminary posterior sclerotomy may even allow photocoagulation in these cases. (3 figures, 4 references) L. T. Post, Jr.

11

RETINA AND VITREOUS

Badtke, G. **Different forms of fundus colobomas and colobomatous cysts and their relation to each other, their nomenclature, and their genesis.** Klin. Monatsbl. f. Augenh. **138**:176-190, 1960.

Developmental processes leading to different forms of coloboma are described. It is emphasized that in so-called choroidal colobomas the primary defect lies in a coloboma of the retina. The author suggests that the term coloboma of the choroid be replaced by the expression retinal coloboma, or more generally, fundus coloboma. Accordingly cysts originating from such colobomas should not be described as orbital or lid cysts but colobomatous cysts. Different forms of coloboma and colobomatous cysts are described and differentiated from each other. One case of ectatic coloboma and two cases of colobomatous cysts are reported. (9 figures, 1 reference)

Gunter K. von Noorden.

Bardelli, A. M. and Vedovini, F. **Electroencephalographic tracings showing involvement of the central nervous system in retinitis pigmentosa.** Arch. di ottal. **64**:283-290, Sept.-Oct., 1961.

The authors have reviewed the literature and present 25 cases of retinitis pigmentosa in which EEG studies were made. In 17 cases, the EEG tracings showed convulsive focal or diffuse 14-6 cycles per second spike discharges. These abnormal discharges were interpreted as cerebral changes of the same pathogenesis as the retinitis pigmentosa. The disease is hereditary, and it may be accompanied by cerebral and internal ear atrophy as in tapetoretinal degeneration. (1 table, 2 figures, 16 references) Paul W. Miles.

Borrás, A. **Fundus changes in gestosis. Report of the findings in 150 cases.** Arch. oftal. Buenos Aires **35**:348-350, Oct., 1960.

Purely vascular changes, chiefly in the form of attenuated retinal arteries, were seen in 77.4 percent of all cases. Hemor-

rhages and white exudates appeared in 12 cases (8 percent) and papilledema in only six (4 percent), and were consistently of bad prognostic significance for both mother and child; surprisingly, none of these 18 patients suffered from eclamptic convulsions. Of the two patients who showed a retinal detachment, one died in uremia and the other had very high blood pressure (230/150 mm. Hg).

A. Urrets-Zavalía, Jr.

Busacca, A. **Embryological and anatomical principles of zonulysis and vitreous prolaps into the anterior chamber.** Bull. et mem. Soc. franç. d'opht. **72**: 146-157, 1959.

After a detailed description of the fetal vitreous, the author discusses the variations of vitreous hernias into the anterior chamber after cataract extractions. Slit-lamp examinations make it possible to differentiate four types of vitreous prolaps, namely, hernias covered by the anterior hyaloid membrane, hernias covered by the plicata, hernias covered by intravitreal lamellas and finally hernias incompletely covered by loose filaments. Comparative studies of aphakic eyes in which alpha-chymotrypsin was used at surgery revealed that the primary vitreous had been destroyed together with the zonula and that the secondary vitreous and the overlying plicata appeared in the pupil. This observation was considered to be a proof of a joint origin of zonula and primary vitreous. This observation also is essential in an explanation of the action of alpha-chymotrypsin.

Alice R. Deutsch.

Dolcet, L. **An unusual case of myelinated nerve fibers.** Arch. Soc. oftal. hispano-am. **21**:74-77, Jan., 1961.

A case is reported in a boy, 14 years of age, whose visual acuity in the right eye was counting of fingers at 30 cm. The loss of vision was due to a large quantity of very dense myelinated nerve fibers, which surrounded the optic disc and extended over and beyond the macula. He had a small degree of divergent strabismus, which the author attributes to the amblyopia. Brief reference is made to unusual cases of myelinated nerve fibers. (3 figures)

Ray K. Daily.

Görtz, H. **Resorptive forces in retroretinal exudates.** Klin. Monatsbl. f. Augenh. **138**:496-498, 1961.

Colloid-osmotic measurements of blood serum in normal individuals and patients with detachment were performed in connection with similar determinations on the physico-chemical properties of subretinal fluid and vitreous. The purpose of this study was to answer the question in which manner subretinal fluid may disappear spontaneously. The results of the investigation revealed that the onkotic pressure of the vitreous can be neglected. However, the pressure quotient between subretinal fluid and choroidal blood barrier was measured to be 1:10 in detachments of recent origin and 1:2 in older detachments. It is concluded that the subretinal fluid leaves the eye by way of the choroidal blood circulation rather than the vitreous and anterior chamber. (1 reference)

Gunter K. von Noorden.

Gould, Herbert, and Kaufman, H. E. **Ophthalmic review. Sarcoid of the fundus:** A.M.A. Arch. Ophth. **65**:453-456, March, 1961.

Forty of the 66 reported cases are analyzed. One third showed a chorioretinitis characterized by yellow waxy infiltrates near the veins. This is pathognomonic of sarcoid and the lesions resemble candle wax drippings. Periphlebitis, granulomatous tumors, nonspecific chorioretinitis, and vitreous opacities were also noted. There was an increased incidence of central nervous system involvement when fundus lesions were present. There was

no anterior uveitis in one third of the cases. Vision was not compromised when fundus lesions were found alone. (1 figure, 1 table, 46 references)

Edward U. Murphy.

Hruby, K. **Hyaluronic acid as vitreous substitute in retinal detachment.** Klin. Monatsbl. f. Augenh. **138**:484-496, 1961.

Vitreous was implanted in 17 eyes during surgery for retinal detachment. A technique described by D. M. Shafer was employed. Reattachment of the retina was achieved in nine of these patients, who for the most part presented complicated cases with poor prognosis. In one patient, however, endophthalmitis caused by pseudomonas occurred after vitreous implantation and resulted in subsequent loss of the eye. The self-sterilizing effect of human vitreous described by Shafer and others could not be confirmed. The author advises against the use of vitreous from human cadavers unless a strict bacteriologic examination of the specimen has been performed. He reports on the results of his experimentation with hyaluronic acid obtained from cattle eyes. This substance is free of pyogenic organisms and proteins and is atoxic. Hyaluronic acid was injected into the globe during 35 operations for detachment. No complications were observed, provided a solution not stronger than 2 mg/ml was employed. The indications and the technique of injection are discussed. (1 figure, 3 tables, 15 references)

Gunter K. von Noorden.

Kozakiewicz, Angelina. **Pigmentary degeneration of the retina and hearing disturbance (Usher's syndrome).** Klinika Oczna **31**:59-61, 1961.

The author describes three patients with deafness and retinitis pigmentosa. All three were also color blind. One had some speech defect and another was deaf and dumb. The author feels that this syndrome is not a coincidence. The similarity of tissues of the retina and of the inner ear, and also their common ectodermal origin, explain the simultaneous appearance of these manifestations. (7 references)

Sylvan Brandon.

Lijo-Pavia, J. **Modification of ophthalmoscopic appearance as a prognostic tool in diseases of the retina.** Ann. d'ocul. **194**: 289-295, April, 1961.

The author states and illustrates his thesis that only by repeated fundus photography can the true course of a retinal disease be evaluated. (5 figures, 8 references)

David Shoch.

Malbran, E. and Dodds, R. **Clinical classification, operative selection, and surgical results in retinal detachment.** Klin. Mónatsbl. f. Augenh. **138**:465-485, 1961.

Experiences collected from the study of 517 patients with retinal detachment are evaluated. Preoperative bedrest with atropinization and binocular dressings are essential for the detailed clinical study of the individual case. The following classification is employed by the authors: Type 1: tears and holes without detachment or with subclinical detachment, Type 2: uncomplicated detachment with a pronounced tendency toward reattachment after bedrest and binocular dressings, and Type 3: other types of detachment, such as myopic or aphakic detachment, and complication by vitreous retraction or retinal folds. According to this classification the surgical evaluation, indication, and operative results in 358 cases are discussed. Increased cures in patients operated upon in more recent years are the result of improvement of the surgical methods. Decrease of the ocular volume, creation of a permanent contact between retina and choroid, and elimination of ocular hypotony are surgical goals which can be achieved by drainage of the subretinal fluid, encircling tubes (Schepens),

intrascleral implants, and vitreous implantations. The techniques of these procedures are described. (2 tables, 29 references) Gunter K. von Noorden.

Malbran, E. S. and Dodds, R. A. **Some technical details in retinal detachment surgery.** Ophthalmologica **140**:289-296, Nov., 1960.

The authors present a general discussion of technical niceties in retinal detachment surgery which they feel are of importance in obtaining good results with a minimum of complications. Their experience is gleaned from 370 operations (the majority were scleral shortening procedures) performed over a four-year period in Buenos Aires. They recommend 1. an almost invariable, lateral canthotomy, for better exposure, 2. dissection of the conjunctiva from Tenon's capsule to allow a layered closure, with the aim of cutting down on post-operative adhesions, 3. the removal of one muscle on first operations and two on subsequent interventions; they warn against severing three muscles from the globe, which has led in their hands to segmental iris atrophy and disturbances in intraocular pressure, 4. like all other authors, a bare minimum of diathermy, 5. drainage of subretinal fluid from a site considerably removed from the location of the retinal break, in order to prevent a gush of fluid and inclusion of vitreous through the break into the scleral wound and for the same reason they prefer placing this scleral incision proximal to the buckle, so that the buckle remains as a barrier between the retinal hole and the scleral opening; (the incision is made with a knife and is closed with a pre-placed suture), 6. covering the muscle insertions with a Tenon's capsule flap to prevent adhesions and postoperative phorias, and, finally 7. only the shortest period of bed rest after scleral shortening operations, which has caused no complications in their experience. (9 references) L. T. Post, Jr.

Münich, W. **Experiments on the influence of α-chymotrypsin upon the human vitreous body.** Arch. f. Ophth. **163**:88-98, 1961.

In this study of post mortem eyes, proteolytic action upon the structural proteins of the vitreous could be demonstrated in every case. It was more marked with higher concentrations (1:5000) and less so in younger persons. (6 figures, 62 references) Harri H. Markiewitz.

Pears, M. A. and Pickering, G. W. **Changes in the fundus oculi after hemorrhage.** Quart. J. Med. **29**:153, April, 1960.

Severe hemorrhage, usually gastro-intestinal, may be followed by one of two types of retinopathy: (1) sudden blindness followed by optic atrophy, and (2) lesions similar to albuminuric retinitis. One case of the former is presented: unilateral papilledema followed by optic atrophy was noted. The underlying process in this phenomenon is not known; but sudden severe ischemia with resulting necrosis of the ganglion cells of the retina is postulated. Retinal changes similar to those of hypertensive retinopathy are more commonly found following exsanguination. However, the question is left unanswered whether the causative mechanism is the same as that of hypertensive retinopathy. Thomas H. F. Chalkley.

Pommier, M.-L. **Retrolental fibroplasia. (Retinopathy of premature infants.)** J. Med. Lyon **41**:1585-1591, Dec. 5, 1960.

Retrolental fibroplasia and its relation to oxygen therapy in the newborn is discussed. Thomas H. F. Chalkley.

Renard, G., Dhermy, P. and Amar, L. **Considerations on vitelliform degeneration of the macula.** Arch. d'opht. **20**:797-803, Dec., 1960.

The authors report an additional case of vitelliform degeneration or "cyst" of the macula and review it in relation to the ten previously reported cases in the literature. The subject was a five-year-old girl without visual complaints in whom the symmetrical macular lesions were discovered in routine examination during a mild attack of conjunctivitis. The round, symmetrical lesions appeared to lie behind the retina, or between it and the pigment epithelium, and no cyst-like structure could be seen with the slitlamp. Examination two years later showed that the lesions in both eyes had undergone marked modification with diminution in size, change in color, and pigment infiltration. The authors conclude that the disease is a congenital anomaly without effect on vision which, because of eventual alteration, is diagnosed only in early life. (4 figures, 1 table, 7 references)

P. Thygeson.

Schmidt, J. G. H. **The neuraminic acid content in various mammalian eyes. III. The vitreous body.** Arch. f. Ophth. **163**: 10-18, 1961.

Neuraminic acid may be detected by the author's methods in the vitreous fluid of man, cattle, horse and pig. (3 figures, 26 references) Harri H. Markiewitz.

Vena Rodriguez, Antonio. **The relation of posterior vitreous detachment to retinal detachment.** Arch. Soc. oftal. hispanoam. **21**:110-118, Feb., 1961.

The author reviews the literature and reports eight cases of posterior vitreous detachment, two of which were followed by retinal detachment. When no retinal detachment occurred the posterior hyaloid was inserted at the ora serrata, whereas the hyaloid was attached close to the equator in the two patients with retinal detachment. Of five patients with retinal detachment three had posterior vitreous detachment with collapse, and two had extensive lacunar degeneration of the vitreous. The author refers to Goldmann's work on the relation of retinal detachment to posterior vitreous detachment. He concludes that in cases of posterior vitreous detachment in which there is a clear separation between the hyaloid and the posterior limiting membrane of the retina there is no danger of retinal detachment. (8 figures, 15 references). Ray K. Daily.

Wolter, J. R. **Diabetic capillary microaneurysms of the retina.** A.M.A. Arch. Ophth. **65**:847-854, June, 1961.

This preliminary report presents evidence for a relation of intervascular mesodermal strands to capillary microaneurysms and supports the recent work of Ashton. (18 figures, 23 references)

Edward U. Murphy.

NEWS ITEMS

EDITED BY DONALD J. LYLE, M.D.
411 Oak Street, Cincinnati 19, Ohio

News items should reach the editor by the 10th of the month. For adequate publicity, notice of postgraduate courses and meetings should be received three months in advance.

DEATHS

Dr. Cecil Hopkins Bagley, Baltimore, Maryland, died April 15, 1961, aged 67 years.

Dr. Perce DeLong, Philadelphia, Pennsylvania, died March 12, 1961, aged 80 years.

Dr. Henrik Sofas Graeser, Woodland, California, died February 26, 1961, aged 52 years.

Dr. John Arthur Kerst, Springfield, Illinois, died March 10, 1961, aged 65 years.

ANNOUNCEMENTS

COOK COUNTY COURSE

The Cook County Graduate School of Medicine in co-operation with the Department of Ophthalmology of Cook County Hospital, Chicago, will conduct a two-day intensive postgraduate course in ophthalmology on October 6th and 7th. Dr. Joaquin Barraquer, Barcelona, Spain, and Dr. Richard G. Troutman, New York, will be the guest speakers. The topics to be discussed are: cataract surgery, corneal grafting, organization of a surgical department, plastic lenses in the anterior chamber. The tuition fee of $50.00 is payable upon registration. For further information and application forms address: Registrar, 707 South Wood Street, Chicago 12, Illinois.

GLAUCOMA SEMINAR

A seminar on glaucoma with particular emphasis on gonioscopy and the study of the anterior angle will be given at the Brooklyn Eye and Ear Hospital on November 13th, 14th and 15th. Ample opportunity for practical instruction in the use of the gonioprism will be given and material from the glaucoma clinic will be utilized. The course will be directed by Dr. Daniel Kravitz, assisted by Drs. Nicholas P. Tantillo and Samuel Zane. Registration is limited to six (6) ophthalmologists. Application and the fee of $50.00 may be addressed to: Dr. Daniel Kravitz, Brooklyn Eye and Ear Hospital, 29 Greene Avenue, Brooklyn 38, New York.

SURGERY OF THE CORNEA

A full-time course of five days' duration will be held on November 13th through 17th at the New York University Post-Graduate School.

The course will present all the practical aspects of corneal surgery, including anatomy, physiology, indications and contraindications, instrumentation, techniques, results, postoperative care and complications of keratectomies and keratoplasties.

Mornings will be dedicated to the discussion of clinical material, with patients, and to the observation of corneal surgery techniques. On the last morning students perform on cat eyes several of the techniques demonstrated during the course. The fee for the course, given under the direction of Dr. Ramon Castroviejo, is $250.00. For application: Office of the Associate Dean, New York University Post-Graduate Medical School, 550 First Avenue, New York 16, New York.

COURSE IN CORNEAL SURGERY

A concentrated course in corneal surgery of three days' duration will be offered at the Brooklyn Eye and Ear Hospital on Thursday, Friday and Saturday, December 7th, 8th, and 9th, under the direction of Dr. A. Benedict Rizzuti.

Present surgical concepts of various phases of corneal surgery will be stressed. Allied subjects, such as instrumentation, beta radiation, contact lenses and operating room photography, will be discussed. Surgical procedures in the operating room will be demonstrated according to availability of donor material. Participants will be offered an opportunity to apply surgical techniques on animal eyes. The course is limited; tuition is $100.00. Direct inquiries to Mr. Fred Upton, Administrator, Brooklyn Eye and Ear Hospital, 29 Greene Avenue, Brooklyn 38, New York.

TRACHOMA CONTROL IN SOUTH VIETNAM

A project for trachoma control in South Vietnam, which will be operated in conjunction with an ophthalmic surgery service in a hospital in that country, offers a post paying $8,000.00 a year to a resident ophthalmologist who may serve for a period of one to two years. The ophthalmologist who undertakes this appointment will have the responsibility for all ophthalmic cases in this hospital where ample beds and clinical material are available. Transportation overseas and food and housing will be provided. For further details apply to Dr. Eliott B. Hague, 1109 Delaware Avenue, Buffalo 9, New York.

INTERIM CONGRESS

The Pan-American Association of Ophthalmology will hold an interim congress in Lima, Peru, January 28, through February 3, 1962. All opthalmologists are invited to attend.

The three official subjects to be featured are diagnosis and nonsurgical therapy of glaucoma (round table), steroid therapy (symposium), and cornea (individual papers). Postgraduate courses

will be given at this congress in English, Spanish and Portuguese. Simultaneous translations will be available during the discussion of the official subjects. Outstanding authorities have indicated their plans to participate in the meeting.

Free papers will also be presented. Applicants for papers of any type from the U.S.A. and Canada should send titles and abstracts to John M. McLean, M.D., 525 East 68th Street, New York 21, New York, by October 30, 1961.

Movies should be submitted in advance to Dr. Benedict Rizzuti, chairman of the movies program, 160 Henry Street, Brooklyn 1, New York, for approval and inclusion in the program.

Scientific exhibits are under the chairmanship of A. D. Ruedemann, Jr., M.D., 1633 David Whitney Building, Detroit 26, Michigan.

Official travel agent for the meeting is Mr. Edward R. Brown, Harvey Travel Bureau, 2005 West Gray, Houston 19, Texas. Planned tours before and after the meeting and charter flights are being arranged. Past experience has shown that a central travel agency, such as this, is in a better position to handle all travel expeditiously and more reasonably than through individual arrangements. Those who make arrangements early enough will receive the benefit of having the best accommodations in the same hotel where the meeting will take place. The tours to Machu Picchu will necessarily be limited in number and arrangements must be made early. Outstanding social events are being planned.

Western Section Meeting

The Association for Research in Ophthalmology, Western Section, will meet on November 10th and 11th, at Asilomar, Monterey Peninsula, Pacific Grove, California. The meeting will combine research papers with a postgraduate course entitled "Symposium on corneal diseases." The guest speakers for the postgraduate course will be Drs. Maumenee, Thygeson, Kimura and Burns.

Registration will be limited. Those desiring to attend please contact Dr. Daniel Vaughan or Miss M. Pong at the University of California, Department of Ophthalmology, San Francisco, for further details.

Wright Lectureship

The Walter W. Wright Lectureship,, under the joint sponsorship of the Department of Ophthalmology, University of Toronto and the Toronto Faculty of Medicine, will be given by Dr. Michael J. Hogan at the Toronto General Hospital on November, 17th, at 4:00 P.M. The title will be "Present knowledge of the etiology of iritis." Previous to the lecture the alumni of the Department of Ophthalmology of the University of Toronto will hold its annual clinical meeting. In the evening there will be a banquet and dance at the Royal York Hotel.

Societies

West Virginia Academy

At the recent meeting of the West Virginia Academy of Ophthalmology and Otolaryngology, at the Greenbrier Hotel, White Sulphur Springs, West Virginia, the following officers were installed for the coming year: President, Dr. Albert C. Esposito, Huntington; president-elect, Dr. William K. Marple, Huntington; vice president, Dr. James T. Spencer, Charleston; secretary-treasurer, Dr. Worthy W. McKinney, Beckley; director (1962), Dr. Allen Fawcett, Wheeling; director (1963), Dr. Ralph W. Ryan, Morgantown. Also on the executive committee are the two immediate past presidents, Dr. N. K. Joseph of Wheeling, and Dr. J. A. B. Holt of Charleston. The next annual spring meeting will again be held at the Greenbrier Hotel on April 22 to 25, 1962. For any additional information please contact the secretary, Dr. W. W. McKinney, 109 East Main Street, Beckley, West Virginia.

Southern Medical Association

The Section on Ophthalmology of the Southern Medical Association will meet in Dallas, Texas, November 6th to 9th. On the first day there will be a television surgical clinic on glaucoma. Texas Day will be in the afternoon, with retinal detachment and light coagulation the subjects to be discussed.

On Tuesday there will be papers on "Reflections on glaucoma and tonometry," "Complications of glaucoma surgery," "Myco-keratopathy," "The Use of Sanders Neurotoxoid I in the treatment of herpes simplex infections of the cornea," "Using chymotrypsin in the treatment of dendritic ulcers," "Corneal lesions." Wednesday will be devoted to a symposium on "Corneal diseases and contact lenses." Dr. Trygve Gundersen of Boston, Massachusetts, will be the guest speaker.

For additional information contact the secretary, Dr. Albert C. Esposito, First Huntington National Bank Building, Huntington, West Virginia.

Personal

Dr. J. Winston Duggan has been appointed associate professor of ophthalmology and head of the Division of Ophthalmology, Department of Surgery, University of Alberta. He succeeds Dr. M. R. Marshall.

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